



J. E. Hall

PRELIMINARY

LAND PLANNING AND CLASSIFICATION REPORT
AS IT RELATES TO THE
PUBLIC DOMAIN LANDS
IN THE

**UPPER MISSOURI RIVER
BASIN**



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A MISSOURI RIVER BASIN INVESTIGATION

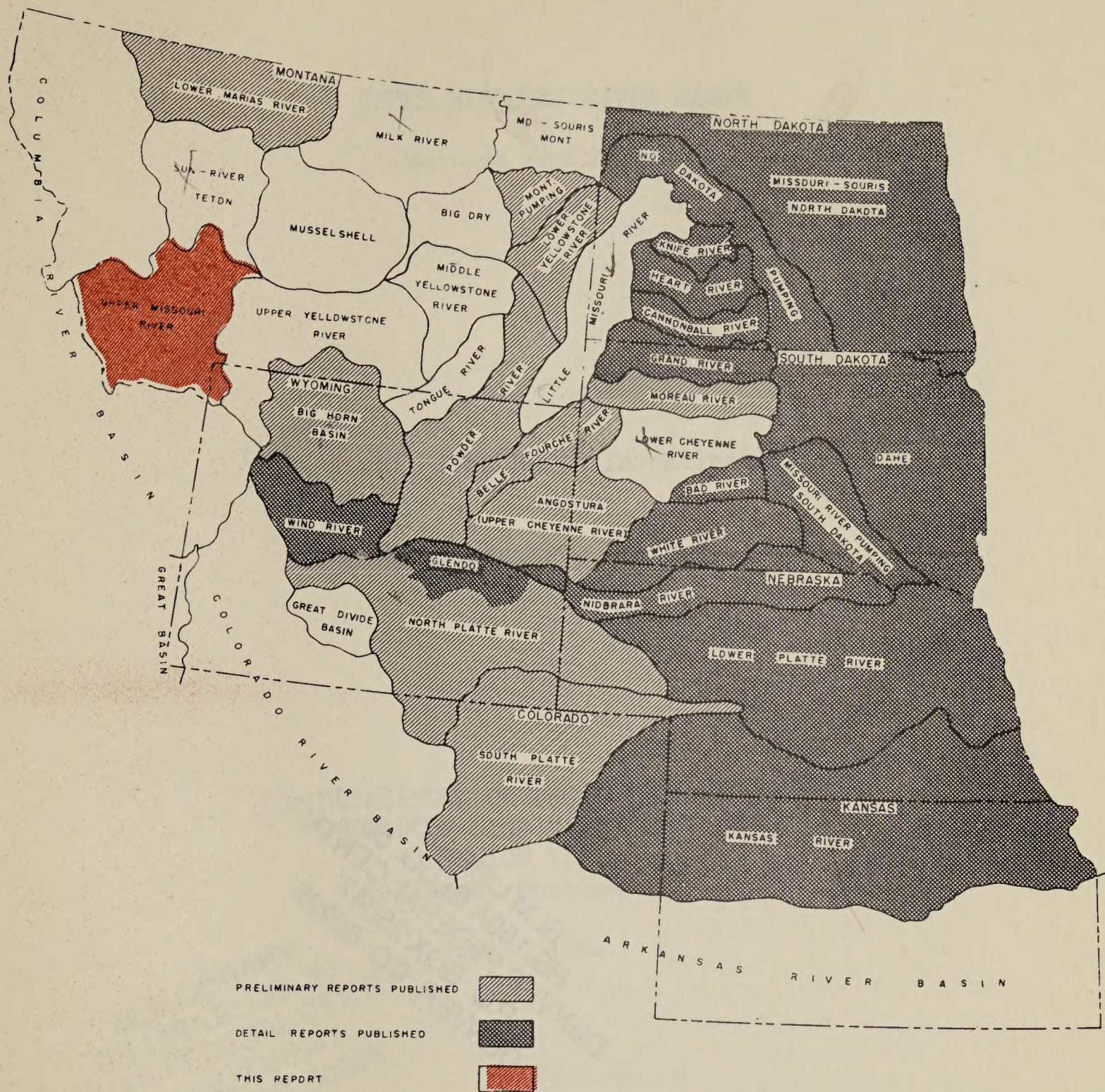
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Preliminary
Land Planning and Classification Report
as Relates to the Public Domain Lands
in the

UPPER MISSOURI RIVER BASIN

(Montana and Wyoming)

(A Missouri River Basin Investigation)

(For Administrative Use Only)

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
REGION III
Billings, Montana

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This study is a feature of the program of the
Department of the Interior for the development of the
resources of the Missouri River Basin

PREFACE

This report of the Upper Missouri River Basin presents a preliminary analysis of the physical and economic features of the area in Montana and Wyoming embraced within the headwaters of the Missouri River tributary to Canyon Ferry Dam which is located near Helena, Montana. The purpose is to describe pertinent features which relate to the program for the development and use of the public domain lands in the comprehensive resource development program for the Missouri River Basin. The report is intended to serve as a guide in carrying out detailed studies of problems pertaining to the use and management of approximately one and one-quarter million acres of public lands administered by the Bureau of Land Management in furtherance of the integrated comprehensive resource developmental program of the Department of Interior in the Missouri River Basin. The appended map of the Upper Missouri River Basin shows the location of land in different types of ownership.

A general analysis is made of the different land tenure and land management programs operating in the basin in order to bring out the relationships of public domain lands and their resources with other resources and their effect upon the over-all economy of the basin. It thus serves to direct attention to the broad land-use and land management problems prevailing in the area as a whole, thereby providing a logical basin-wide perspective for the detailed studies to follow. This report contains factual information for a reconnaissance survey of the Upper Missouri River Basin and pertinent published reports and records. The report broadly describes the major types of land tenure, the complete land ownership pattern, and directs attention to such problems as maladjustments in public land use, watershed impairment and sedimentation. Problem areas requiring further investigation are delineated and a complete and detailed examination and report will follow this preliminary study.

Records and reports of governmental agencies were reviewed for pertinent information, and representatives of several agencies were contacted in the field. The county agents of Beaverhead, Broadwater, Deer Lodge, Gallatin, Jefferson, Madison, and Silver Bow Counties provided important information. Field reconnaissance work, the assembly and analysis of important factual data, and the preparation of the report were conducted by Dale J. Buxton, Range Conservationist, with the assistance of W. R. Sholes, Mineral Examiner, Richard H. Bauman and C. R. Peteler, Range Conservationists, and Fred Benson, Area Manager. The study in all its aspects was under the direction of R. D. Nielson, Regional Chief, Division of Land Planning, Bureau of Land Management, Region III, Billings, Montana.

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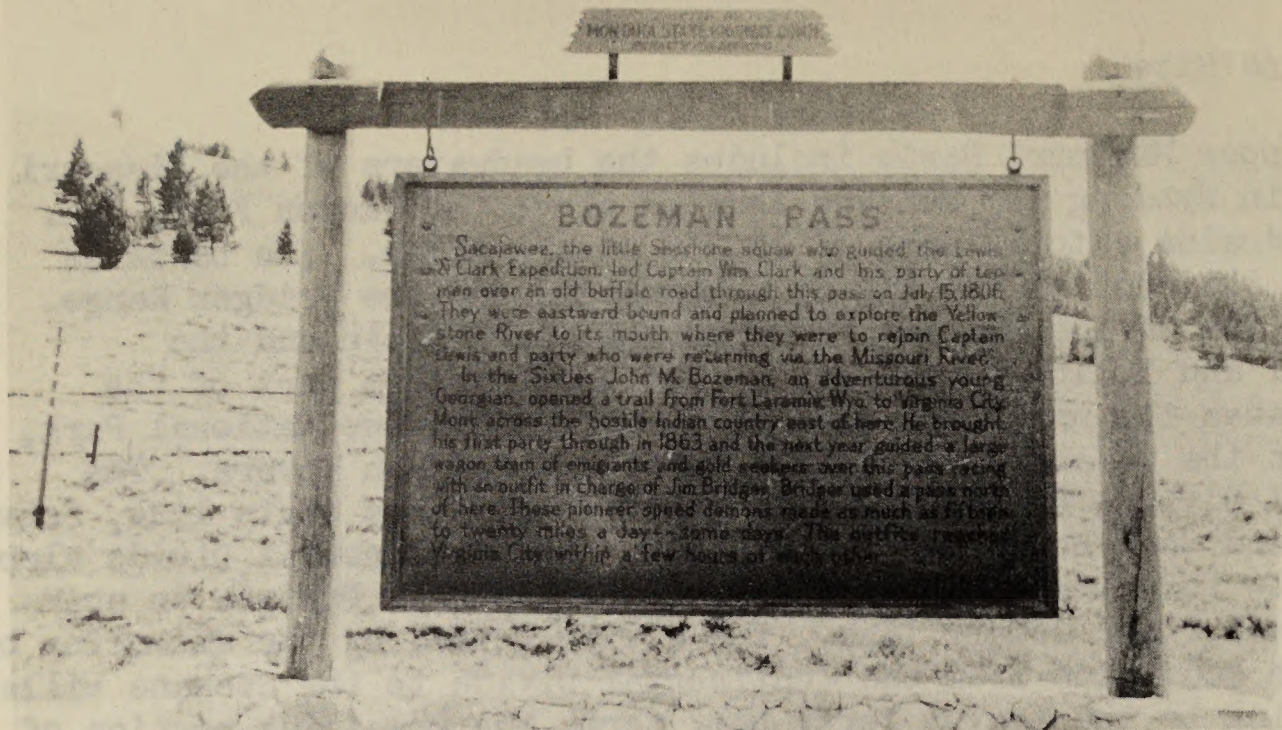
GENERAL DESCRIPTION

Location and Size

The Upper Missouri Basin includes the headwaters of the Missouri watershed in Wyoming and Montana located above the Canyon Ferry Dam. The basin drains a total area of 15,860 square miles. The basin is bounded on the east by the Big Belt Mountains and the Bridger Range, which form the divide between the Upper Missouri Basin and the Musselshell and Yellowstone Rivers. The southeastern part of the basin embraces the northwestern portion of Yellowstone National Park, which is in the watershed of the Gallatin and Madison Rivers. The Continental Divide, coincident with the Montana-Idaho state line, forms the south and west boundary of the basin. The Continental Divide also continues to form the north boundary of the basin in Montana to near the Lewis and Clark County line. The divide formed by the extension of the Elkhorn Mountains from the Continental Divide to the Spokane Hills, and extending to the Canyon Ferry Dam, forms the remaining portion of the north boundary of the basin. These boundaries, drainages, and mountain ranges, as well as the culture of the area, are shown on the map of the basin appended to this report.

The area of Upper Missouri Basin distributed by counties in Montana and Wyoming is as follows:

Montana	Area (Acres)
Beaverhead County	3,550,302
Broadwater County	771,527
Deer Lodge County	181,240
Gallatin County	1,624,631
Jefferson County	932,912
Lewis and Clark County	18,040
Madison County	2,279,675
Meagher County	130,838
Park County	36,160
Silver Bow County	262,860
Yellowstone National Park	89,000
Total Montana Area	9,877,185
Wyoming	
Yellowstone National Park	303,960
Entire Watershed Area	10,181,145



Sign at east entrance into the Upper Missouri Basin from the Yellowstone drainage giving the history of the pass.

Climate

The climate of the Upper Missouri Basin varies from semi-arid in the intermountain valleys to sub-humid in the higher mountain sections. The Continental Divide of the Rocky Mountains exerts a marked influence on the climate of the basin. Conditions west of the basin are modified to a considerable extent by the influence of the Pacific Ocean, while the basin itself is primarily under continental influences.

The annual precipitation ranges from less than 10 inches in the vicinity of the Canyon Ferry Dam to more than 30 inches in the mountains above Hebgen Dam. It is this mountainous area that provides the bulk of the water for the irrigation of lands in the lower valleys. Snow accounts for a considerable part of the total precipitation in the higher mountain districts. In some of the higher ranges, snow may be expected at any time of the year. Snow cover over the lower valleys is seldom continuous through the winter because of the drifting action of wind and melting of snow by warm winds known as "chinooks." A snow cover is favorable for overwintering of plants and the prevention of soil erosion, but it limits the use of the ranges for winter grazing. Monthly, seasonal, and annual precipitation for 18 stations in the basin is presented in table 1.

The basin is traversed by, or is in close proximity to, the principal storm paths of the northwest. Mass air movements of contrasting characteristics generally follow one another from September to June in relatively rapid succession, resulting in marked instability of weather conditions and temperature. Midsummer temperatures of 100° or more have been recorded during the day, but the nights are invariably cool and pleasant. Minimum temperatures of -64° have been recorded. West Yellowstone, a station in the basin, frequently registers the lowest temperature in the nation.

Although the summer season is short, crop growth is stimulated by the long, hot days with abundant sunshine. The growing season is highly variable in length, elevation being the principal limiting factor. The average frost-free period ranges from 30 to 137 days. Successful production of farm crops is ordinarily not possible where this period is less than 90 days. Temperature, elevation, and frost-free period data for 18 stations in the basin are shown in table 2.

The prevailing wind direction is from the west. These winds are somewhat stronger during the late winter and early spring than at other times, and in dry seasons may cause soil drifting and damage to early planting of small grains. "Chinooks" frequently occur during the winter months, diminishing accumulations of snow in the lower part of the intermountain basin. Damaging hailstorms often occur during late spring and summer months. The different mountain ranges have some influence on air drainage and on the paths of local storms; consequently, some localities have longer frost-free seasons and less hail damage than other localities.

Physiography

The surface features of the basin are largely the result of geological forces which produced the mountain ranges during the Cretaceous and Tertiary periods followed by subsequent erosion and deposition of colluvial-alluvial material on the mountain slopes and in the intermountain basins. The more prominent physiographic features of the basin include mountains, foothills, intermountain basins, tablelands, benchlands, gently rolling land, and valley streams. Minor physical features include volcanic cones, stream gorges, sulphurated springs, hot water springs, isolated igneous and sedimentary ridges, rock outcrops and riverwash. These physical features are hereafter described principally from the standpoint of the topography of the different physiographic areas.

The main range of the Rocky Mountains forming the Continental Divide outlines the southern and western boundary of the basin. Its average elevation is 8,000 feet with the higher peaks rising to more than 11,000 feet above sea level. Many of the mountain peaks rise

Table 1. - Average Annual, Seasonal and Monthly Precipitation at Upper Missouri River Basin Stations, Montana, 1950 (inches) 1/

Location and Station	Elevation (feet)	Length of Record (years)	January (inches)	February (inches)	March (inches)	April (inches)	May (inches)	June (inches)	July (inches)	August (inches)	September (inches)	October (inches)	November (inches)	December (inches)	Annual (inches)	Seasonal, Apr. through Sept. (inches)
Western Mont. C. of E.	5,228	50	0.28	0.38	0.90	0.87	3.59	4.68	1.60	0.89	0.93	0.15	0.35	0.95	14.97	11.96
Grant	5,800	27	0.54	0.45	0.69	1.07	1.63	1.35	1.00	0.86	1.08	0.82	0.65	0.65	10.79	5.91
Lima	6,265	31	0.02	1.08	0.34	1.87	3.30	2.72	0.84	1.40	1.51	0.70	0.30	0.55	14.63	11.64
Wilsdon	6,058	19	1.05	1.22	1.37	0.75	2.71	2.18	1.54	0.71	0.82	0.06	0.90	0.35	13.65	7.96
Townsend	3,833	22	1.54	0.25	0.21	0.47	1.78	4.14	2.93	0.80	0.67	0.30	0.94	0.71	14.74	10.79
Balgrade Airport	4,450	9	1.16	0.59	0.70	0.95	2.30	6.22	2.26	2.62	0.55	0.23	1.16	0.96	19.70	14.90
Boreman	4,856	57	1.11	0.65	0.89	2.04	2.37	4.87	1.58	1.91	0.60	0.52	1.53	1.43	19.50	13.37
Three Forks	4,400	28	0.25	0.35	0.39	0.94	1.63	1.91	0.99	0.68	1.24	0.86	0.53	0.48	10.25	7.39
Trident	4,086	13	0.44	0.06	0.25	0.45	2.51	5.26	1.82	2.11	0.70	0.12	0.57	0.68	14.94	12.85
Boulder State School	4,884	34	0.24	0.38	0.26	0.16	1.69	5.74	2.07	1.87	0.48	0.01	0.31	1.21	14.12	11.71
Whitehall Airport	4,598	16	0.16	0.24	0.30	0.13	2.28	3.81	2.73	0.76	0.84	0.30	0.34	0.91	12.80	10.55
Canyon Ferry	3,470	51	1.00	0.28	0.13	0.99	3.40	3.58	1.63	1.36	0.59	0.01	0.79	0.75	14.51	11.55
Fannin	5,000	32	0.29	0.06	0.15	0.53	2.36	3.02	1.19	1.09	0.70	0.18	0.64	0.40	10.62	8.89
Hybgen Dam	6,550	47	2.81	1.49	2.26	2.36	2.57	3.16	0.96	1.20	1.68	0.90	4.26	3.78	27.43	11.93
Morris Dam	4,729	43	0.98	0.50	1.12	1.52	2.73	4.28	1.91	1.62	0.94	0.52	1.37	1.34	18.83	13.00
Virginia City	5,847	46	0.49	0.46	1.06	1.87	2.25	2.04	1.18	1.11	0.57	0.64	0.97	1.66	14.29	9.02

1/ Compiled from Montana records of Weather Bureau, U.S. Department of Commerce, 1941-1950 incl.

Table 2. - Average Temperature Data for Selected Stations in
Upper Missouri River Basin, Montana, 1950 1

Stations	Length of Record	Elevation	Temperature (degree Fahrenheit)			Average killing frost		Average length of growing season (days)
			Average	January	July	Maximum	Minimum	
Belgrade Airport	9	4,450	18.8	62.8	94	-33	Sept. 26	131
Boulder State School	34	4,884	22.6	62.5	90	-24	Sept. 6	87
Bozeman College	57	4,856	22.6	64.6	91	-20	Sept. 16	115
Canyon Ferry	51	3,470	22.0	64.4	94	-24	Sept. 22	132
Dillon West'n Col. Educ.	50	5,228	25.9	63.1	91	-22	Sept. 12	113
Ennis	32	5,000	23.6	61.9	91	-20	Sept. 11	101
Grant	27	5,800	16.2	60.1	102	-52	Sept. 9	88
Hebgen Dam	47	6,550	10.4	59.6	87	-32	Sept. 13	85
Lima	31	6,265	18.8	60.0	92	-18	Sept. 17	94
Norris Dam	43	4,729	27.8	66.3	93	-11	Sept. 29	137
Three Forks	28	4,400	21.7	65.5	101	-43	Sept. 11	105
Townsend	22	3,833	21.9	63.8	98	-26	Sept. 26	88
Trident	13	4,036	25.0	66.6	94	-19	Sept. 26	131
Virginia City	46	5,847	22.3	63.2	92	-19	Sept. 18	91
West Yellowstone	15	6,669	10.3	58.1	93	-48	July 17	30
Whitehall Airport	16	4,598	25.4	62.7	92	-22	Sept. 26	118
Wisdom	19	6,058	14.4	54.8	96	-42	Sept. 1	67

1 Compiled from Montana records of Weather Bureau, U.S. Department of Commerce, 1950.

from 3,000 to 4,000 feet above the valley floor. Almost everywhere in this mountainous area one finds striking evidence of glaciers which have long since disappeared.

The rugged and roughly rolling foothills are largely short ridges extending out from the mountains between the drainage courses. Many of these ridges are capped with stony outwash, while others consist of barren outcrops of limestone and slate. The foothills in the northern part of the basin consist chiefly of limestone ridges through which the Missouri River has eroded a deep gorge. Ridges known as the Spokane Hills rise 1,000 feet or more above the river. The Spokane Hills are quite rugged and are sparsely covered with timber. In most sections, the mountain ranges do not have foothill zones distinct from the mountains. The intermountain basin, such as the Big Hole and Townsend Basins, is considered by geologists as the site of inland lakes formed during the Oligocene Epoch. Water accumulated behind the foothills before the Missouri River cut its present channel through the hills to the north.

Within the basin, high gravel-capped tablelands occur on the slopes of the Belt and Elkhorn Mountains and the Gravelly and Madison Ranges. These tablelands vary in elevation from 4,600 to 6,000 feet above sea level and are dissected by entrenched streams. Benchlands, occupying lower erosional levels and probably of Pleistocene Age, border the Missouri River on the east between Toston and Canyon Ferry. The area south of Willow Creek and Three Forks rises to the south in successive benches toward the foothills of the Madison Range. These benches lie between 3,600 and 4,200 feet above sea level. The gently rolling lands of the basin are the areas which are used for dry farming such as the areas west of the Missouri River in Broadwater County and the areas south of Willow Creek in and around Harrison, Montana. Much of Gallatin County is dry farmed because of the combination of suitable physiography, soils, and climate. Benchlands in the vicinity of Dillon are also utilized for dry farming. Most of the basin is sharply rolling land which is suitable chiefly for grazing, timber production, wildlife, and recreation. Mountains and foothills and adjacent slopes make up most of the area.

The valleys are comparatively high intermountain areas which vary from 4,000 to 7,000 feet in elevation. The lowest elevation in the basin is about 3,470 feet above sea level at the site of Canyon Ferry Dam. The higher valley areas are located in the upper end of the Red Rock Valley at elevations of about 7,200 feet above sea level. In the lower parts of the valleys, many of the stream banks are poorly defined and the waters make their way through the gravel bottoms by a series of interlacing, meandering streams. Lands adjacent to streams are usually irrigated for hay production. The Big Hole Valley and Beaverhead Valley are famous hay regions.

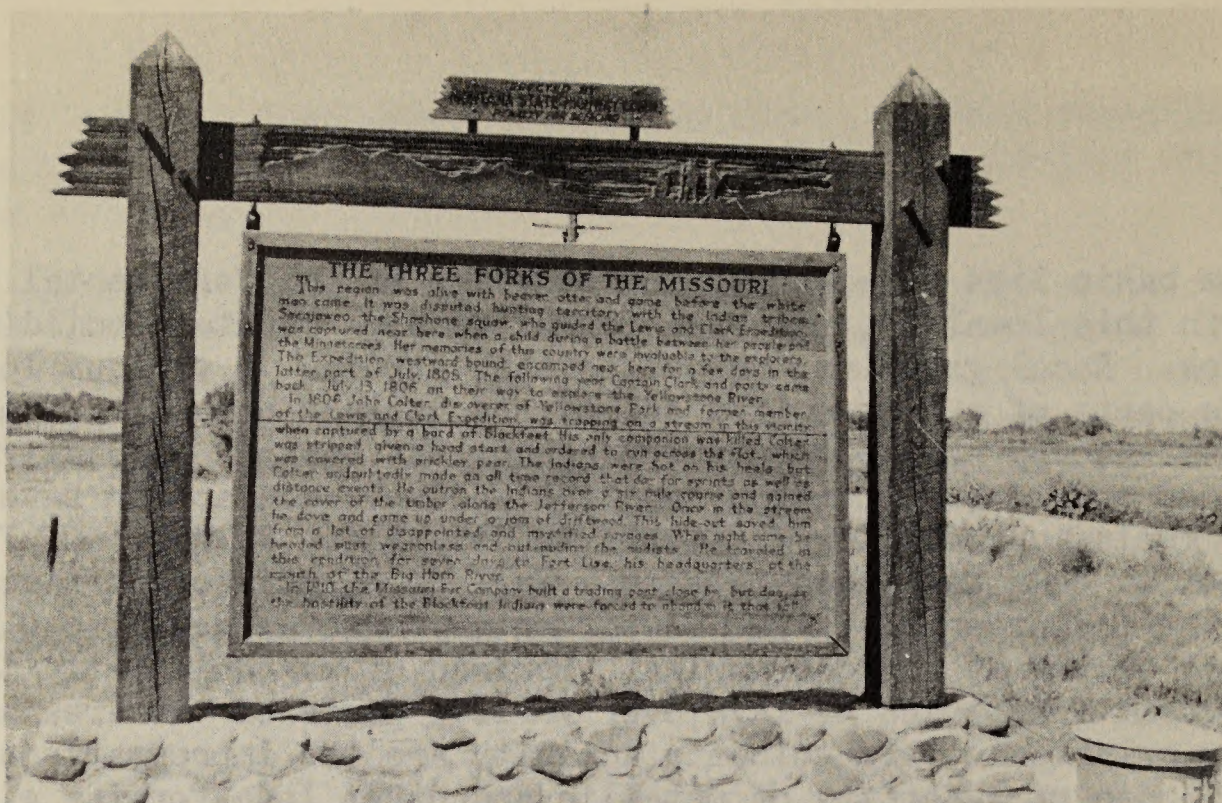
Geology

The basin lies adjacent to the backbone of the Continental Divide which, in this locality, has been formed through mountain-building processes. Basal granites, or monzonites, exposed in various localities are parts of a huge uplift called the Boulder Batholith, which extends northerly and southerly throughout the basin. Successive periods of erosion, deposition, upsurge and volcanic action have a complex geologic condition difficult to describe. Folding and faulting of older beds have been intense. Periods of quiescence have permitted the formation of valuable sedimentary mineral deposits which are now found tilted at various angles. Periods of volcanic activity have spread great quantities of lava over various parts of the area and possibly related to this volcanic activity are the impregnations and vein fillings of a variety of metallic and other lode-forming minerals valuable in our economic life today.

Much of the land surface, after the mountains were formed, was occupied by an immense lake, in the bed of which great deposits of gravels, sands, and clays were laid down. Later erosion, including glacial action, created more deposits. Accordingly, it appears certain that immense deposits of valuable minerals are covered to an extent as to be entirely inaccessible for many generations to come. One of the three areas in the world in which geysers occur is located in Yellowstone National Park within the basin. The geyser basins of the park, including Old Faithful Geyser and other spectacular geysers and famous hot water pools, are located there. These unusual geologic features now attract over one million visitors per year.

Drainage

The Missouri River extends 60 miles above the Canyon Ferry Dam to the point of its formation at the confluence of the Jefferson, Madison, and Gallatin Rivers a few miles northeast of Three Forks, Montana. These three rivers and their principal tributaries form a mature and well established drainage pattern for the entire basin. Below the junction of the three rivers, the course of the Missouri runs through mountain valleys and deep canyons from which it finally emerges through a gorge in a range of rocks called "Gates of the Rocky Mountains" located just below Canyon Ferry Dam.



Historical marker at site of the confluence of the Jefferson, Madison and Gallatin Rivers to form the Missouri River.

The flow of the Missouri River varies greatly, the ordinary high-water discharge at Canyon Ferry Dam being about 28 times the usual low water discharge. The freshets are caused by melting snow and heavy summer rains. The regular flood stages usually occur in May, June, and July. The June discharge is the greatest. Thereafter the river steadily decreases in volume and the minimum is reached during the winter. Daily rate of discharge of the Missouri River near Townsend, Montana, near the lower end of the study area, has varied from 1,020 second feet to 52,500 second feet with an average flow of 5,840 second feet. The Madison and the Gallatin Rivers, and many other mountain tributaries, afford excellent storage sites and facilities. The waters of the Beaverhead, Big Hole, Red Rock, Gallatin, Madison and Jefferson Rivers furnish large supplies of water for irrigation. The basins of Gallatin, Madison, Jefferson, and the Missouri Rivers, although extensively utilized, still offer opportunities for additional irrigation and water storage.

Streamflow records and watershed areas of the principal streams in the Upper Missouri River Basin are as follows:

Stream	Distance		Drainage Area (Sq. Miles)	Average Annual Discharge	
	Above Canyon Ferry Dam (miles)	Location		(CFS)	(Acre Ft.)
Upper Missouri R.	45	Toston	14,000	5,860	4,242,444
Jefferson River	135	Silver Star	7,840	1,744	1,262,598
Beaverhead River	159	Barratts	3,000	420	304,066
Madison River	85	Three Forks	2,485	1,560	1,129,388
Big Hole River	185	Melrose	2,470	1,030	745,686
Gallatin River	88	Logan	1,805	886	641,434
Red Rock River	240	Lima Reservoir	560	165	119,454
Ruby River	175	Alder	537	140	101,355
Madison River	208	W. Yellowstone	419	469	339,540
Boulder River	140	Boulder	350	99	71,673
South Boulder Cr.	105	Jefferson Is.	25	32	23,167
Willow Creek	92	Willow Creek	164	53	38,370

(Data in this tabulation were adapted from U. S. Geological Survey Water Supply Paper 1077, December, 1948. Average cubic feet per second flow (CFS) has been converted to acre-feet per year by using the factor 723.96655.)

Soils

The soils of the Upper Missouri Basin, like those of most inter-mountain areas in the west, present a wide variation in development. The character of such parent geological material as colluvial-alluvial material, till, loess, shale, sandstone and limestone greatly influences the biological activities and the chemical and physical properties of the soil and plays an important part in the basic separation of soils. The predominating soil within the basin has been developed from stratified, gravelly and sandy material on the secondary benches or terraces. The surface soils of this series are grayish-brown in color, and in most places have lime accumulations within a few inches of the surface. The soils have a wide range in texture; but, they are two general types, gravelly loam and stony loam. They are chiefly utilized for grazing land.

In general, soils of the valleys are moderately deep, black, clayey loams and make excellent farm lands. Subsoils are calcareous, light yellowish-brown silts underlain by loose sand and gravel at varying depths. Soils on the more gently sloping benchlands and coalescing alluvial fans adjacent to the mountains are usually deep, sandy loams which are covered with needleandthread and blue grama grass and associated grasses and shrubs. These soils are lighter in color than most of the soils being irrigated and are situated in areas where dry farming is practiced to some degree.

The greatest part of the Upper Missouri Basin is characterized by brown to gray soils, usually low in organic matter content. The land occupied by these soils is largely used for grazing. The soils in this group include the rough broken and mountainous land which are untillable because of steepness or stoniness. Most of it, however, is good grazing or timber lands. Available moisture is usually the limiting factor in productive ability.

Vegetation

The four major vegetative types within the boundaries of the Upper Missouri Basin are: short grass, bunchgrass, northern or intermountain shrub, and coniferous forest.

The short grass type is found on the lower foothills and valleys. The precipitation is low, from 10 to 15 inches, of which about 75 per cent is received as rain between April and September, and the remainder, mostly as snow, during the winter months. The vegetation is shallow-rooted and is largely dependent upon moisture which falls during the growing season for growth. The short grass types, over large areas, are dominated almost exclusively by blue grama and associated species of needleandthread grass, bluestem wheatgrass, prairie junegrass, and bluebunch wheatgrass. Intermixed with these dominant grasses are various other grasses, forbs, and shrubs which include threadleaf sedge, fringed sagebrush, snakeweed, winterfat, and plains pricklypear. Because of their low stature, the grasses of the short grass type are very resistant to heavy grazing, but continued heavy use or overgrazing will cause them to give way to less palatable plants. Large areas of benchland support a practically pure stand of needleandthread. The grasses of the short grass type are highly nutritious and are ideally suited to cattle use. Use by sheep on the short grass type is decreasing.

The bunchgrass type is found at higher elevations where the precipitation ranges from about 12 to 20 inches, most of which falls in the winter in the form of either rain or snow. The most important grass of this type is bluebunch wheatgrass. The associated grasses in this type are Idaho fescue, green needlegrass, Sandberg bluegrass, and prairie junegrass. In some areas, Idaho fescue is the dominant grass. On heavier, more moist soils, giant wild ryegrass and bluestem wheatgrass are the dominant grasses. On most of the bunchgrass areas in the Upper Missouri Basin, big sagebrush is found growing along with the bunchgrasses, usually giving a sagebrush aspect to the vegetative type. Important herbs found in the bunchgrass type are balsam root, lupine, yarrow, and sunflower. Other minor herbs are found in different localities, depending upon elevation and moisture. In many

areas, heavy grazing has led to the invasion of this type by such annual grasses as wildoats and cheatgrass. Principal use of this type is made by cattle, sheep, and big game.

The northern or intermountain shrub type in the Upper Missouri Basin is found on rolling to very steeply rolling sites. These sites have wide variations in elevation and exposure with correspondingly large differences in soil and microclimate. Most of the precipitation comes in the non-growing season and, as a result, the vegetation is either deep-rooted or else matures before the summer droughts. This type is dominated by big sagebrush with rabbitbrush, greasewood, bitterbrush, and other intermountain shrubs intermixed with the sagebrush. In most of the areas, the intermountain shrub type and the bunchgrass type coalesce, and it is hard to differentiate between the two types. Lowlands and creek bottoms are often found composed of an almost pure stand of greasewood with very little undergrowth. The most important grass found in the shrub type is bluebunch wheatgrass. Other associated grasses are cheatgrass, bluestem wheatgrass, giant wildrye, and various species of bluegrass. Various forbs are to be found, depending upon exposure, moisture and other conditions, among which the most important are arrowleaf balsam root, dock, aster, sticky geranium, and showy milkweed. The most abundant forb in areas where sagebrush has been disturbed or removed by fire and plowing is tumbling russian thistle. The differentiation between this type and the bunchgrass type is due mainly to soil types and moisture. In most areas, the two types tend to intermix and are principally used by sheep.

The coniferous forest type is found occupying the higher and more moist regions of the basin, and is characterized by evergreen trees, the principal species being common Douglas fir, lodgepole, and whitebark pine, Engelmann spruce, and alpine fir. In parts of the basin there are large areas covered with a pure stand of lodgepole pines. These lodgepole forests predominate in and near Yellowstone National Park. In many areas little or no grass is found under the timber because of the density of the trees and rockiness of the soil. Forage species in the coniferous forest type are most commonly found where the timber is fairly thin and in open meadows and parks. The principal grasses included are Idaho fescue, bluebunch wheatgrass, pinegrass, threadleaf sedge, and various species of bluegrass. The forbs are mainly arnica, lupine, and aster. The coniferous forest type is used as summer range by both cattle, sheep, and also by game animals.

ECONOMIC AND CULTURAL DEVELOPMENTS

Population

The total population in the Upper Missouri Basin in 1950 was approximately 42,700 people. Of this amount, 28,400 lived on rural farms and 14,300 lived in communities of over 3,000. The total population in 1940 was 41,228 people. The average number of inhabitants per square mile in 1950 was 2.8 as compared with 2.4 in 1930. Bozeman, Montana, the county seat of Gallatin County, and home of the Montana State Agricultural College, is the largest town in the basin. There are 11,252 residents which is about 26 per cent of the total population of the area. It is situated in the Gallatin Valley with an elevation of 4,856 feet and serves as an important cultural and commercial center. The Gallatin Valley area is one of the most important agricultural areas of the northern Rocky Mountain states. Bozeman is a gateway to one of the nation's greatest attractions, the Yellowstone National Park.

Dillon, Montana, second largest town in the basin with a population of 3,079 residents, is the county seat of the largest county in the state, Beaverhead. It is situated in the Beaverhead Valley with an elevation of 5,228 feet, and serves as an important marketing and shipping center for a large livestock and agricultural region in this area. The Union Pacific Railway connects Dillon with Butte and areas to the south. The Western Montana College of Education is located at Dillon. Seed potato production is centered here.

Townsend, Montana, third largest town with a population of 1,316 residents, is the county seat of Broadwater County. It is a principal shopping center for one of the important agricultural areas of the basin.

Several other towns should be mentioned here because they are important to the economy of the Upper Missouri Basin. According to the 1950 population census, they are: Three Forks, 1,106; Boulder, 1,013; Whitehall, 818; Manhattan, 646; Belgrade, 618; Sheridan, 597; Lima, 554; Twin Bridges, 534; Ennis, 400; Virginia City, 380; Willow Creek, 350; Pony, 350; West Yellowstone, 300; Basin, 250; Harrison, 225; and Toston, 200.

Rural schools are scattered throughout the area, and high schools are located in all of the towns mentioned. Nearby cities of Butte, Helena, and Livingston also provide educational facilities. Besides the State Agricultural College at Bozeman and the Western Montana College of Education at Dillon, the Montana School of Mines is located at nearby Butte, and Carroll College is at Helena.

Transportation Facilities

The existing system of railroads and highways provide the basin with a sufficient network for rapid shipment of all types of produce, resource products, and manufactured goods. The principal shipping centers for this area are Bozeman, Three Forks, Whitehall, Dillon, and Logan, all within Montana. The transcontinental main line of the Northern Pacific railroad crosses the northern part of the basin, entering on the east, near Bozeman, Montana, continuing by way of Three Forks and Whitehall to Butte, Montana, and on to the coast. The Northern Pacific has four short feeder lines in the study area: one from Whitehall to Alder, a branch from Willow Creek south through Harrison, Montana, to Norris, Montana; and another branch goes south from Manhattan to Anceney. A spur line follows the Gallatin River from Manhattan, Montana, eastward to Bozeman. A transcontinental branch of the Northern Pacific goes by way of Logan, Montana, north to Helena, Montana. The main line of the Chicago, Milwaukee, St. Paul, and Pacific Railroad, from Chicago to Tacoma and Seattle, enters the basin in the northeast near Ringling, Montana. Its route across the basin is southwest to Lombard, thence south to Three Forks where it follows the Jefferson River to Whitehall; thence, it continues in a southwesterly direction to the Continental Divide and goes on to Butte, Montana, and west. The Los Angeles-Salt Lake City-Butte route of the Union Pacific railroad enters the state at Monida, Montana, and traverses the Beaverhead Valley to Armstead and Dillon, then north to Reichle, Montana, where it follows the Big Hole River to Divide, then north across the Continental Divide and terminates at Butte. The Great Northern Railroad from Helena to Butte crosses the basin just north of Boulder. The Yellowstone Park branch line of the Union Pacific from Idaho Falls extends into the area and terminates at West Yellowstone. A branch line of the Milwaukee road extends eastward from Three Forks up the Gallatin River to Gallatin Gateway, Bozeman, and northward to Menard.

There are no railroads providing outlets for produce in the south-central portion of the area, but an oiled highway, U. S. No. 191 and State Highway No. 1, provide excellent highway transportation from this area to Bozeman and Three Forks. Other highways which provide access through the basin are U. S. No. 10S, 10N, 91, and the oiled State Highways No. 1, 34, and 41. These are all-weather highways providing the principal means to market outlets for a great part of the basin. Graveled roads connecting the farms and ranches to these highways and a network of county roads provide excellent farm-to-market routes.

Industries

Livestock raising and farming, the principal industries of the basin, engage a large portion of the total working population. The estimated value of crops, livestock, and livestock products sold in 1949 was \$35,000,000. Estimated value of 1951 agricultural production in the basin is \$50,000,000. Other important economic enterprises in the basin

are mineral production, timber products, and hydroelectric power production. Gross production of all minerals, including cement, is valued at about \$5,500,000 annually at the present time. Timber products total 15,000,000 board feet annually, and are valued at \$750,000. Hydroelectric power produced at the Madison River plant near Ennis may be valued at \$762,120. No consideration is given for production of the old plant at Canyon Ferry which terminated power production in April, 1951. The new plant at Canyon Ferry Dam is planned to produce 285,100,000 kilowatt hours of electricity annually from the 50,000 kilowatt capacity powerhouse. If this production were to be valued at one cent per kilowatt hour, the annual power value would be \$2,851,000; at five mills per kilowatt hour, the valuation would be \$1,425,500. Total non-agricultural industrial production of the Upper Missouri River Basin is estimated to be in excess of 10 million dollars annually. Total annual production from the natural resources of the area, including farming and grazing, will be about 60 million dollars annually on the basis of 1951 prices.

Montana's only cement plant is located at Trident, near Three Forks. It is the largest industrial establishment in the area. This plant is owned by the Ideal Cement Company and manufactures Portland and mason's cement. Capacity is 3,000 barrels per day and is being expanded to match the increasing demand for cement in the trade area. The plant is located at the site of extensive deposits of limestone. Employees total 200. The plant is in continuous operation.

The Montana Power Company operates a hydroelectric plant near Ennis on the Madison River. This power plant has four twin turbo-generators with a total name plate capacity of 10,000 kilowatts and an actual production of 8,700 kilowatts per hour. It is tied into the Montana Power system grid. Built in 1907, the plant is becoming outmoded. Power is generated from a flow of 1,400 second feet of water. There are 16 employees. Annual production of 76,212,000 kilowatt hours would be worth \$762,120 if electricity is valued at one cent per kilowatt hour at the plant.

There are three flour mills in the area—two in Bozeman and one in Belgrade. These mills are operated by Montana Flour Mill Company, Fisher Flour Mill Company, and BonTon Bakery. A cannery in Bozeman processes Gallatin Valley peas. Four cheese factories operate in the basin. There are 13 creameries in the area; 8 manufacture butter, 8 make ice cream, 7 process milk, and 4 make cottage cheese.

Minerals in the area are an important portion of the economy. Phosphate rock is produced near Divide for processing into mineral phosphorus at the new plant of the Victor Chemical Company, located near Butte, just outside of the basin. A mill at Silver Star concentrates copper ore for three small mines located there. Large deposits

of steatite talc south of Ennis and southeast of Dillon are being actively developed. There are large reserves of this material in the area. There is also a graphite mine southeast of Dillon which is not being operated at present. Largest deposit of corundum, another strategic mineral, is located on Elk Creek approximately 16 miles southwest of Bozeman. Lode mining for gold, silver, lead, zinc, and copper has long been important in the area, and will become increasingly important with higher prices now available for the strategic metals. In 1948, the value of these five metals produced in the area was \$1,435,899. Gross value of cement produced at the Trident plant annually is estimated to be \$3,500,000. Annual production value of steatite talc and phosphate rock is estimated at \$350,000. Present active development of these minerals will increase this production value.

Exploration work, mainly at shallow depths, is reported to give indications of one of the largest low-grade tungsten deposits in the United States. This deposit is located in Beaverhead County which is about 15 miles northwest of Dillon. Tentative plans by the mining interests are to construct a large concentration plant near Glen which is located on the Union Pacific Railway. Uranium is being developed northwest of Boulder on property owned by the Elkhorn Mining Company. This deposit was found in a silver mine owned by the company. Several cars of uranium ore have been shipped. Indications are that the ore is of high grade. This development will substantially increase the value of mineral production from the area.

Virginia City and Bannack, pioneer mining camps of Montana Territory, exploded into being during the years 1862 and 1863 when pay dirt was hit on the Grasshopper and Alder Creeks. Considerable gold was taken from these areas during the early days. There is still a little mining activity going on in both of these areas today. Bannack was the first territorial capital of Montana and Virginia City was the second. Today the miners have gone and these first cities of Montana are of interest to tourists for their history.

Visitors to Yellowstone National Park contribute importantly to the economy of the area. West Yellowstone, a city of 300 year-round inhabitants, has elaborate accommodations, including a splendid Union Pacific Railroad terminal. Gallatin Gateway and Bozeman also largely benefit from Yellowstone traffic. Hunting and fishing, afforded by the large area of national forest land in the basin, attract many sportsmen. Several dude ranches are located in the area. Numerous hunting camps, catering to hunters, are active during the hunting season. Skiing is an important winter sport in this area. Lima is a division point on the Union Pacific Railroad, and is an important railroad town. Rail and truck, service trades, and tourism contribute to the general area economy.

LANDOWNERSHIP

The complexity of the land ownership is best illustrated by the map accompanying this report. The gross area of the basin is 10,181,145 acres, of which 97 per cent, or 9,877,185 acres, is in Montana; and 3 per cent, or 303,960 acres, is in Wyoming. The five principal agencies of the Federal Government that administer lands in the basin are the Bureau of Land Management, Forest Service, Fish and Wildlife Service, National Park Service, and Bureau of Reclamation. The mountainous areas are mostly within national forests. Public domain lands occupy foothills and slopes adjacent to the national forests and other mountainous, rough, and rolling lands in the basin. Bottom and bench lands, which make up the agricultural lands, and the higher-grade grazing lands are mostly in private ownership with some in state ownership. State lands in the area are largely concentrated in big blocks. Yellowstone National Park occupies the extreme southeastern part of the basin. The headwaters of the Madison and Gallatin Rivers make up the portion of the park within the basin.

Thirty-five per cent of the gross area is administered by the Forest Service; 12 per cent by the Bureau of Land Management; and 3 per cent, contained within Yellowstone National Park and the Big Hole National Monument, is administered by the National Park Service. Less than one per cent is administered by the Fish and Wildlife Service, and a small fraction of one per cent is under the jurisdiction of the Bureau of Reclamation.

Six per cent of the gross area of the basin is comprised of lands owned by the state and administered by the Montana Department of State Lands and Investments. The greater part of the state lands in the basin, or 55 per cent, are contained within Beaverhead County; another 25 per cent in Madison County; and the remaining 20 per cent is scattered among the other 8 counties. Lands in private ownership embrace 42 per cent of the entire basin.

A total of 1,236,615 acres are under the custody of the Bureau of Land Management, of which approximately 658,057 acres are in the grazing district. The greatest concentration of public domain lands occurs in the southwestern portion of the basin in Beaverhead and Madison Counties. This pattern persists in the southeastern portion of Silver Bow County, but gradually becomes more scattered in the lower valley of the Jefferson and Madison Rivers, and the main stem of the Missouri River. A comparatively small percentage of the land in Gallatin County and the eastern portion of Broadwater County is public domain. Tables 3 and 4 show the distribution of land ownership by states and counties both within the grazing district and outside of the grazing district.

Table 3 - Land Ownership in the Upper Missouri River Basin by Counties and by Location Within and Outside of Montana Grazing District 5, 1949, (acres) 1/

Total Area Administered by the Bureau of Land Management All Land Ownerships Inside Grazing District M5	Montana										Total
	Beaverhead	Broadwater	Deer Lodge	Gallatin	Jefferson	Lewis & Clark	Madison	Meagher	Park	Silver Bow	Yellowstone Nat'l. Park
Public Domain	715,811	71,015	6,640	12,200	112,771	2,880	266,640	3,198	320	45,140	1,236,615
Public Water Reserve 2/	345,291	60,155	4,520	---	110,811	---	92,420	---	---	43,500	656,697
Power Sites 2/	520	80	---	---	160	---	120	---	---	---	880
Red Rock Lakes National Wildlife Refuge	---	---	---	---	480	---	---	---	---	---	480
Fish and Wildlife Service	40,008	---	---	---	---	---	---	---	---	---	40,008
DuBois Experiment Station U.S. Dept. Agriculture	16,001	---	---	---	---	---	---	---	---	---	16,001
Lewis and Clark Cavern State Park	---	---	---	---	2,770	---	---	---	---	---	2,770
Private	367,450	116,496	17,960	---	410,443	---	117,630	---	---	82,980	1,112,859
State	123,440	11,920	960	---	29,178	---	19,280	---	---	5,880	190,658
Sub-Total	892,710	188,651	23,440	---	553,840	---	223,450	---	---	132,260	2,020,353
All Land Ownership Outside Grazing District M5	334,640	10,780	2,120	12,080	1,320	1,279	154,100	3,198	320	1,480	521,317
Public Domain	34,480	---	---	---	---	---	19,220	---	---	---	53,700
Stock Driveway 2/	960	---	---	120	---	---	120	---	---	160	1,360
Public Water Reserve 2/	---	---	---	---	---	---	580	---	---	---	580
Power Sites 2/	---	---	---	---	---	1,601	---	---	---	---	1,601
Reclamation Withdrawal 2/	---	---	---	---	---	---	---	---	---	---	---
National Forests	1,361,920	192,000	108,160	635,626	361,600	6,400	824,050	12,160	18,560	107,520	3,627,996
Yellowstone National Park, Wyoming	---	---	---	---	---	---	---	---	---	---	303,960
Yellowstone National Park, Montana	---	---	---	---	---	---	---	---	---	---	89,000
Big Hole Nat'l. Monument	320	---	---	---	---	---	---	---	---	---	320
Private	719,920	363,309	46,080	924,365	16,680	7,680	928,583	109,440	17,280	19,520	3,152,857
State	205,352	16,787	1,440	52,440	---	1,080	123,572	6,040	---	1,920	408,631
Sub-Total	2,657,592	582,876	157,800	1,624,631	379,600	18,040	2,050,225	130,838	36,160	130,600	8,161,322
Total Basin Area	3,550,302	771,527	181,240	1,624,631	933,442	18,040	2,279,575	130,838	36,160	262,860	10,181,675

1/ Taken from records of the Bureau of Land Management, Forest Service, states and counties.

2/ Withdrawals from, or reserves of, public domain land.

Table 4 - Land Ownership by State and County in the Upper Missouri River Basin, October, 1949 1/

Montana

	Beaverhead	Broadwater	Deer Lodge	Callatin	Jefferson	Lewis & Clark	Madison	Meagher	Park	Silver Bow	State No County	Total
Lands Administered by the Bureau of Land Management	715,811	71,015	6,640	12,200	112,771	2,880	266,640	3,198	320	45,140	---	1,236,615
Public Domain												
Within M-5 Grazing District	345,291	60,155	4,520	---	110,811	---	92,420	---	---	43,500	---	656,697
Outside M-5 Grazing District	334,640	10,780	2,120	12,080	1,320	1,279	154,100	3,198	320	1,480	---	521,317
Stockdriveway Withdrawal	34,480	---	---	---	---	---	19,220	---	---	---	---	53,700
Public Water Reserve	1,480	80	---	120	160	---	240	---	---	160	---	2,240
Power Sites	---	---	---	---	480	---	580	---	---	---	---	1,060
Reclamation Withdrawal	---	---	---	---	---	1,601	---	---	---	---	---	1,601
National Forests	1,361,920	192,000	108,160	635,626	361,600	6,400	824,050	12,160	18,560	107,520	---	3,627,996
Yellowstone National Park, Wyo.	---	---	---	---	---	---	---	---	---	---	303,960	303,960
Yellowstone National Park, Mont.	---	---	---	---	---	---	---	---	---	---	89,000	89,000
Big Hole National Monument	320	---	---	---	---	---	---	---	---	---	---	320
Red Rock Lake Natl. Wildlife Refuge	40,008	---	---	---	---	---	---	---	---	---	---	40,008
United States												
DuBois Experiment Station U.S. Dep't. Agriculture	16,001	---	---	---	---	---	---	---	---	---	---	16,001
Lewis and Clark Cavern State Park	---	---	---	---	2,770	---	---	---	---	---	---	2,770
Private	1,087,370	479,805	64,040	924,365	427,123	7,680	1,046,213	109,440	17,280	102,400	---	4,265,716
State	328,792	28,707	2,400	52,440	29,178	1,080	142,852	6,040	---	7,800	---	599,289
Total	3,550,302	771,527	181,240	1,624,631	933,442	18,040	2,279,675	130,838	36,160	262,860	392,960	10,181,675

1/ Taken from records of the Bureau of Land Management, Forest Service, and States and Counties.

LAND MANAGEMENT PROGRAMS

Bureau of Land Management, Department of the Interior

There are 1,236,615 acres of public domain within the Upper Missouri Basin of which 658,057 acres lie within the exterior boundary of Montana Grazing District V, and 578,478 acres are located outside of the grazing district, as shown in tables 3 and 4.

Grazing districts were established pursuant to the Taylor Grazing Act, approved June 28, 1934, and amended June 26, 1936, "to conserve and regulate the public grazing lands, to stabilize the livestock industry dependent upon them, and, in aid thereof, to promote the proper use of the privately controlled lands and waters dependent upon the public range." It also provided that no vacant, inappropriate public domain was subject to disposition, settlement, or occupation until after the same had been classified and opened to entry. Management of the grazing resources in the grazing districts is accomplished through regulated grazing use and authorized through a system of grazing permits issued to stockmen who own or control sufficient base property to provide for a year-round operation when used with the public land. Permits for such grazing use are issued for a period of ten years, subject to modification or cancellation under certain conditions.

Approximately 33,404 cattle, 1,570 horses, 79,410 sheep and goats, or a total of 50,841 animal units obtained seasonal grazing on the grazing district land in 1949. Detailed range surveys have been made on half of the areas of the grazing district. It is estimated that the amount of forage available from the public lands in the grazing district is approximately 105,000 animal unit months, or about 6.3 acres per animal unit month. In addition, part of the natural forage resources of the area is required for wildlife.

The public domain land outside the grazing district is administered under Section 15 of the Taylor Grazing Act. Practically all of it is leased for grazing. Livestock operators owning or controlling adjacent privately-owned lands are given preference right in leasing the publicly-owned lands. Leases are ordinarily for a period of ten years, but may be for a shorter period, depending upon the location, amount, and permanency of the lessee's holdings.

Reservation of public lands for water reserves was authorized by Executive Order of April 17, 1926, in accordance with provisions of section 10 of the Act of December 29, 1916. The primary purpose of these withdrawals is to provide access by the public for watering purposes. It became apparent, after stock-raising enterprises were established in the basin, that public domain lands would be under the control of large livestock enterprises through the control of watering places unless steps were taken to reserve such watering places for

public use. Within the report area, these reserves comprise a total of 2,240 acres, and are located within and outside the grazing district. These lands are under the jurisdiction of the Bureau of Land Management.

Stock driveway withdrawals were authorized by section 10 of the Stock Raising Homestead Act of December 29, 1916. The primary purpose of the driveways is for use in trailing livestock to summer and winter ranges or to shipping points, as well as provide access to watering places. These withdrawal areas are all located outside the grazing district since the stock driveway withdrawals within the grazing district were cancelled in 1938. Sufficient study has not been made to determine the extent of use and need for these driveways outside of the grazing district.

Bureau of Land Management activities also include the granting of rights-of-way across or upon public lands for canals, ditches, reservoirs, roads, highways, water pipelines, oil and gas pipelines, telephone and telegraph lines, and material sites as provided under the existing laws. It also grants mineral leases and permits on most of the Federal lands and on private lands where the Government has retained the mineral rights. Another function of the Bureau of Land Management is cadastral surveys which officially establish township and section lines for use in describing land areas.

U. S. Forest Service, Department of Agriculture

Part of all of the following national forests are within the Upper Missouri River watershed: Beaverhead, Gallatin, Helena, and Deer Lodge. They comprise an area of approximately 3,627,996 acres within the basin, or about 35 per cent of the total land in the basin. Also included within the boundaries of the national forests are approximately 110,000 acres of primitive areas. The Spanish Peaks Wilderness area is in the Gallatin Forest, and the Pintlar Primitive area is located in the Beaverhead Forest. Summer range of the Dubois Sheep Experiment Station was withdrawn from the public domain and is located on the south side of Centennial Valley. Their range comprises approximately 16,000 acres, and is supervised by the Forest Service in cooperation with the Bureau of Animal Industry.

Bureau of Reclamation, Department of the Interior

The Reclamation Act of June 17, 1902, provided for the classification, survey, and construction of irrigation works to reclaim the public lands. Appropriations for this purpose include receipts from the sale and disposal of the public lands and mineral leases in the sixteen western states. Early irrigation development took place along the streams where water could be diverted to the land by simple structures and at low cost. Later, larger

and more costly irrigation works were constructed which brought water to larger areas. Some of the larger developments are the projects along the Gallatin River, the Upper Madison, the Jefferson, and the main stem of the Missouri River, below Toston, Montana. These projects range in size from 2,000 to 14,000 acres and embrace a total of about 325,368 acres. Lima Reservoir stores water for irrigating Red Rock Valley above Armstead. This earthen dam stores 90,000 acre-feet of water. Ruby Reservoir stores 39,000 acre-feet of water above Alder, Montana.

The reclamation developments under consideration by the Bureau of Reclamation in the basin will make possible the expansion of irrigation in this area. Seventeen units are planned to include all areas of suitable land for which water can be furnished economically. Developments planned will provide for the irrigation water for 180,500 acres now inadequately served. In the plans for reclamation development in the Upper Missouri River Basin, ten reservoirs being investigated have a total capacity of 3,252,900 acre-feet, as shown in table 5. Unit names and the irrigable areas of each are listed in table 6.

Table 5 - Proposed Reservoirs Located in the Upper Missouri Basin, Montana, 1951 1/

Name of Reservoir	Storage Capacity	Units Served
Jefferson Division		
Apex	5,000	West Bench
Bernice	17,100	Boulder
Brenner	15,000	Horse Prairie
Clark Canyon	204,000	East Bench
Landon	21,500	Blacktail
Reichle	898,300	Big Hole
Whitetail	6,000	Whitehall
Three Forks Division		
Beacon	15,000	Gallatin
Eldridge	20,000	Gallatin
Helena-Great Falls Division		
Canyon Ferry	2,051,000	Helena Valley (outside of the report area)
Total	3,252,900	

1/ Bureau of Reclamation, Region 6, Project Planning Division.

Table 6 - Irrigable Area of Proposed Unit Developments
Upper Missouri River Basin, 1951, (acres) 1/

Unit, Division and District	Irrigable Area		Total Land
	New Land	Supplemental Land	
Upper Missouri Basin	194,320	180,500	374,820
Jefferson Division	41,800	43,400	85,200
Big Hole Unit		1,000	1,000
Blacktail Unit	3,100	300	3,400
Boulder Unit		5,700	5,700
East Bench Unit	25,000	14,500	39,500
Horse Prairie Unit	1,300	10,700	12,000
Whitehall Unit	9,400	2,500	11,900
Rattlesnake Unit	2,000	1,100	3,100
Red Rock Unit	1,000	5,600	6,600
West Bench Unit		2,000	2,000
Three Forks Division	152,520	137,100	289,620
Clarkston Unit	2,100		2,100
Crow Creek Gravity Unit	18,100	5,300	23,400
Crow Creek			
Pumping Unit <u>2/</u>	5,020		5,020
Gallatin Unit	44,000	105,500	149,500
Madison Unit	29,700	6,400	36,100
South Bench Unit	27,300	15,900	43,200
Townsend Unit	22,900	4,000	26,900
Valley View Unit	3,400		3,400

1/ Bureau of Reclamation, Region 6, Project Planning Division

2/ Listed as 5,000 acres in 9/18/49 Control Schedule

Canyon Ferry is the first major unit of the Missouri River Basin Project to be placed under construction in Montana. The unit, consisting of Canyon Ferry Dam and Reservoir and Canyon Ferry power plant is located on the Missouri River east of Helena, Montana. Canyon Ferry Reservoir will extend upstream from the dam site about 25 miles to near Townsend, Montana. Canyon Ferry Unit is a multiple-purpose development planned for the control of floods, regulation of the flow of the Upper Missouri River, and generation of electric power. Lands to be irrigated are located outside of the report area, but should be mentioned here since it concerns the watershed of the report area. The dam will make possible the other unit developments planned for the Upper Missouri River Basin. Flood water storage and stream regulation will provide water to take care of water rights of the Montana Power Company. A total of 1,601 acres of public domain lands have been withdrawn for reclamation purposes under the first form of withdrawal authorized by the Reclamation Act of June 17, 1902. They consist of lands near the Canyon Ferry Dam for the protection of the dam site and several tracts in the reservoir area, some of which will be flooded.

Lyon Unit is a power development authorized for construction by the Bureau of Reclamation. If constructed, it will utilize the flow of the Madison River without any storage. An installed capacity of 24,000 kilowatts is planned with an average annual generation of 134,400,000 kilowatt-hours of electrical energy. Sixteen other potential power sites have been investigated in the area by the Bureau of Reclamation. These sites would have a total of 173,900 kilowatts installed capacity to produce 941,400,000 kilowatt hours of electrical energy annually. Data regarding each of the potential sites are listed in table 7.

National Park Service

Eighteen per cent, or 393,000 acres, of Yellowstone National Park lies within the Upper Missouri Basin. Administered by the National Park Service, it is the first of the national parks because it was created by an Act of Congress on March 1, 1872, to preserve an area of outstanding hydro-thermal activity, scenery, and wilderness character. This forested region includes numerous geysers, hot springs, canyons, waterfalls, lakes, and meadows. Its wilderness areas are extensive and provide habitat for many American species of animals, birds, and plants.

The Big Hole National Monument is also under the administration of the National Park Service. The monument was designated to preserve the area where the Battle of the Big Hole was fought, August 9, 1877, between Chief Joseph's band of fugitive Nez Perce Indians and the U. S. Troops under command of General Gibbon.

Table 7 - Potential Hydroelectric Power Developments, Upper Missouri River Basin, 1951 1/

REF. NO.	NAME	STREAM	STATIC HEAD (FT.)	INSTALLED CAPACITY (KW.)	AVERAGE ANNUAL GENERATION (MILLION KWH.)	CLASSIFICATION	TYPE	CAPACITY ACRE FEET
15	Ennis	Madison River	370	58,000	283.2	Good	Earth	680,000
21	Hebgen	Madison River	165	12,000	63.9	Good	Existing	345,000
22	Squaw Creek	Madison River	120	9,500	55.6	Fair	Earth	No data
23	Hippe	Madison River	40	3,000	18.8	Fair	Earth	No data
25	Gallatin No. 1	Gallatin River	240	11,000	51.1	Poor	Concrete	299,500
26	Gallatin No. 2	Gallatin River	70	3,500	15.9	Fair	Concrete	Diversion only
27	Taylor	Taylor Fork	145	1,600	4.8	Poor	Earth	18,400
28	Gallatin No. 3	Gallatin River	70	3,500	15.9	Fair	Concrete	No data
29	Spanish Creek	Gallatin River	300	15,000	84.8	Poor	Concrete	252,000
41	Cold Springs	Boulder River	105	1,300	6.9	Poor	Earth	84,000
52	Glen	Big Hole River	188	14,000	74.1	Fair	Earth	898,000
53	Fishtrap	Big Hole River	86	2,500	16.0	Poor	Earth	179,000
58	Titian	Big Hole River	152	6,000	38.6	Poor	Concrete	125,000
59	Divide	Big Hole River	71	5,500	21.6	Fair	Concrete	No data
78	Clark Canyon	Beaverhead River	90	2,500	9.7	Fair	Earth	90,000
97	Lombard	Missouri River	85	25,000	180.5	Good	Concrete	157,000
	Total			173,900	941.4			
	Total 11 units with data							2,102,900

1/ From table 28, page 96, Power Resources, Requirements, and Supply, M.R.B., Bur. Rec., Regs. 6 and 7. July, 1951.

Fish and Wildlife Service

The Red Rock Lakes National Wildlife Refuge lies within the watershed of the basin. The gross area consists of 40,000 acres which is administered by the Fish and Wildlife Service. In 1935, this refuge was established for the protection of the trumpeter swan, a rare water fowl which was threatened with extinction. The refuge is also used by whistling swans and migratory ducks and geese. This refuge has been successful in protecting the trumpeter swan, and their numbers have increased from 75 in 1935 to 368 in 1950.

State Lands

There is a total of 599,289 acres of state lands in the basin. This land is administered by the Department of State Lands and Investments of Montana. These lands consist primarily of state school lands or indemnity selections granted to the state of Montana by various acts for the support of the different schools. They have exchanged with private and also with the different Federal agencies to block up their state lands in this area, especially in Beaverhead and Madison Counties. In this area, the state lands are mostly suited for grazing and for lease to livestock operators who own or operate adjoining lands.

The Lewis and Clark Cavern State Park is located within the basin and exhibits geological formations said to be more complex than any other cave in the United States. The cavern formations include stalactites and stalagmites, scarfs, helictes, boxes, cascades, crystals, columns, box work, flowstone, and clusters. The gross area comprises approximately 2,770 acres of land administered by the State Park Service. This state park is located on U. S. Highway No. 105 and attracts thousands of visitors each season.

There are two cooperative state grazing districts in the area. The Waterloo Cooperative State Grazing District enters into cooperative agreements with the Bureau of Land Management for the purpose of bringing about a better coordination of the use of all classes of land used for grazing within the boundaries of each district. Pursuant to this agreement, the Bureau of Land Management issues to the state district an annual permit for the grazing privileges that may be utilized on the Federal range in the district by its operators. Subject to review, the Bureau permits the state district to refuse to issue grazing permits to applicants who fail or refuse to pay grazing fees or abide by the rules and regulations of the state district. A grazing permit, which specifies conditions under which the range is to be used and the number of livestock the user is entitled to graze, is issued to eligible livestock operators. Each member is charged a fee based upon the number of livestock grazed on the district lands. In the Tobacco Root Cooperative

State Grazing District, the public lands are leased direct to adjoining land owners.

Soil Conservation Districts

There are six organized soil conservation districts within the basin which cover a gross area of 4,958,933 acres, or about 48 per cent of the total area of the basin. These districts are locally organized, locally administered units organized under the provisions of the state soil conservation district laws which enable ranchers and farmers to work together to conserve soil and water resources. They provide the means for the landowners to analyze their local conservation problems, adopt known erosion control practices and measures, and secure help needed to carry out these practices and measures. Through such districts, the rancher or farmer is provided the service of men technically trained in soil and moisture conservation to help them determine the use to which each acre is best suited and the conservation treatment necessary. Through cooperative agreements with the Soil Conservation Service and other agencies, group action and organization of the farmers and ranchers assures more efficient and more productive use of the land and its resources.

Production and Marketing Administration

The agricultural and conservation program of the Production and Marketing Administration has met with widespread approval and participation by the farmers and ranchers of the basin. The agricultural conservation program is administered through county and community committeemen elected by the local ranchers and farmers to assist them to maintain and improve the soil and water resources on private and state lands. Payments are made by the Federal Government to operators participating in this program of water and soil conservation. Basis for payment is the annual state PMA schedule.

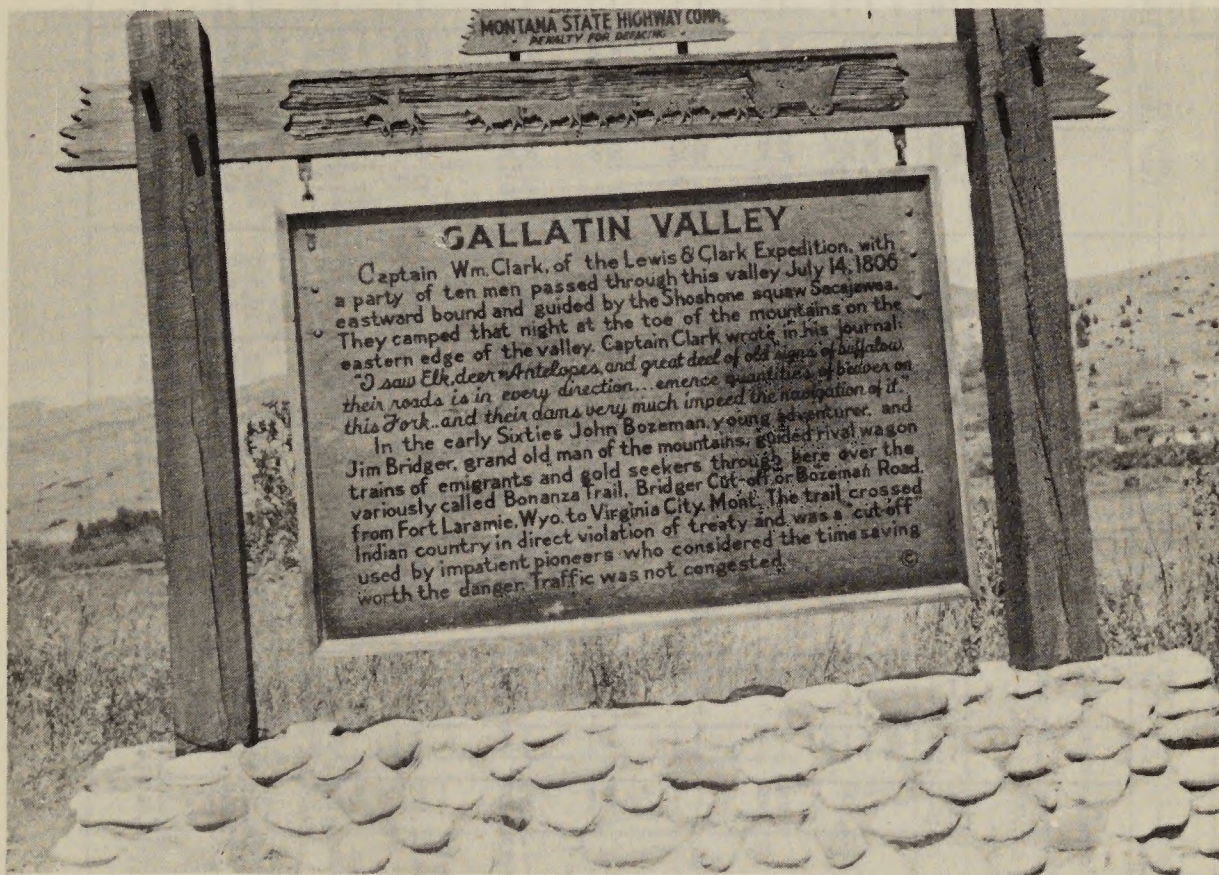
MAJOR LAND USES

Agriculture

Range livestock and farming are the principal agricultural industries in the basin and livestock production is more important than farming. The comparatively large production of land in the basin which is primarily suited for grazing use is the principal factor responsible for the importance of the range livestock enterprise. In 1949 about 6.5 per cent of the lands in the basin were devoted to cultivated crops, about half of which is dry farmed as shown in table 8. Crops from approximately 653,670 acres

were harvested in 1949. Hay crops made up 63 per cent of the total, grains 36 per cent, potatoes a quarter of 1 per cent, and miscellaneous crops three quarters of 1 per cent.

The Gallatin Valley is one of the oldest agricultural areas in the basin. It is the largest and most extensively cultivated area above Canyon Ferry Dam. The principal crops produced in this valley have been about the same since 1880, although the importance of the various crops and their acreage has changed from time to time. Wheat always has been an important cash crop. The next important crop grown in this valley is barley which is extensively used as livestock feed in the feed lots to fatten cattle for market. Crop production in the basin in 1948 and 1949 is given in table 8.



Marker at east entrance into the largest and oldest agricultural area in the basin.

Table 8 - Crop Production in Upper Missouri Basin, Montana, By Counties, in 1948 and 1949 1/

CROPS	Beaverhead		Broadwater		Deer Lodge		Gallatin		Jefferson		Madison		Levis and Clark		Silver Bow		Meagher		Total Upper Mo. Basin	
	1948	1949	1948	1949	1948	1949	1948	1949	1948	1949	1948	1949	1948	1949	1948	1949	1948	1949	1948	1949
Small Grains																				
Winter Wheat	300	500	9,500	18,500	---	---	52,700	53,000	7,500	5,940	13,400	11,400	---	---	---	---	1,200	1,100	84,600	90,440
Acres	6,600	7,500	219,000	426,000	---	---	1,381,600	1,434,800	150,900	150,280	335,700	225,600	---	---	---	---	24,000	22,000	2,117,800	2,266,180
Bushels																				
Spring Wheat	5,100	5,000	11,800	10,000	---	---	33,800	40,800	5,040	6,030	5,800	8,500	---	---	100	100	2,000	1,800	63,640	72,230
Acres	207,100	200,000	357,500	204,000	---	---	1,032,400	1,017,500	151,200	121,230	183,100	207,300	---	---	1,400	1,800	30,000	26,500	1,962,700	1,778,330
Bushels																				
Oats	4,300	4,500	5,500	3,800	---	---	10,100	9,800	900	990	3,700	5,200	---	---	100	100	---	---	24,600	24,390
Acres	214,000	172,500	280,000	222,500	---	---	513,900	469,000	36,540	37,620	191,500	256,000	---	---	3,400	3,500	---	---	1,239,340	1,161,120
Bushels																				
Barley	4,500	4,300	10,100	8,300	---	---	28,500	24,400	3,330	2,070	9,700	7,800	---	---	100	100	---	---	56,230	46,970
Acres	164,700	119,600	388,700	321,500	---	---	1,105,000	934,200	87,300	66,330	290,300	261,400	---	---	3,600	3,400	---	---	2,039,600	1,706,430
Bushels																				
Rye	300	200	100	---	---	---	200	500	450	540	200	---	---	---	400	100	---	---	1,650	1,340
Acres	4,200	1,600	1,600	---	---	---	6,300	9,100	8,100	7,650	2,400	---	---	---	4,000	900	---	---	26,600	19,250
Bushels																				
Flax Seed	900	600	100	---	---	---	---	---	---	---	100	---	---	---	---	---	---	---	1,100	600
Acres	8,700	6,600	1,000	---	---	---	---	---	---	---	700	---	---	---	---	---	---	---	10,400	6,600
Bushels																				
Total Small Grains	15,400	15,100	37,100	40,600	---	---	125,300	128,500	17,220	15,570	32,900	32,900	---	---	700	400	3,200	2,900	231,820	235,970
Acres	605,300	507,800	1,247,800	1,174,000	---	---	4,039,200	3,864,600	434,040	383,110	1,003,700	950,300	---	---	12,400	9,600	54,000	48,500	7,396,440	6,937,910
Bushels																				
Hay																				
Alfalfa	19,000	21,700	13,200	11,100	---	---	31,200	32,500	7,400	4,590	33,600	35,000	---	---	600	400	300	400	105,300	105,690
Acres	43,560	43,400	30,270	21,070	---	---	67,280	73,440	10,350	7,130	61,080	55,000	---	---	960	1,000	650	1,100	214,150	202,140
Tons																				
Wild Hay	191,000	173,000	7,800	6,100	1,600	---	10,600	15,900	7,200	5,400	19,700	18,100	---	---	6,900	6,700	1,900	1,800	246,400	228,600
Acres	194,600	173,000	6,210	4,760	2,080	---	9,680	16,540	5,590	5,270	19,100	17,940	---	---	6,360	5,750	3,200	3,920	246,560	229,260
Tons																				
Other Hay	10,000	19,200	4,800	8,200	350	---	19,700	13,500	7,790	10,080	30,100	18,300	---	---	4,500	4,900	300	360	77,490	74,890
Acres	12,240	25,670	6,360	13,010	650	---	30,260	20,250	6,210	8,850	43,040	22,650	---	---	4,780	5,090	400	520	103,940	96,765
Tons																				
Total Hay	220,000	213,900	25,800	25,400	1,700	---	61,500	61,900	22,390	20,070	83,400	71,400	---	---	12,000	12,000	2,400	2,560	429,190	409,190
Acres	250,400	242,070	42,840	38,840	2,470	---	107,220	110,230	22,150	21,250	123,220	95,590	---	---	12,100	11,840	4,250	5,540	564,650	528,165
Tons																				

(Continued)

	Beaverhead		Broadwater		Deer Lodge 2/		Gallatin		Jefferson 2/		Madison		Lewis and Clark 3/		Silver Bow		Meagher 2/		Total Upper Mo. Basin	
	1948	1949	1948	1949	1948	1949	1948	1949	1948	1949	1948	1949	1948	1949	1948	1949	1948	1949	1948	1949
Potatoes Acreage	520	500	1,400	1,650	---	---	520	590	260	250	590	570	---	---	-20	-20	---	---	3,310	3,586
Bushels	119,600	150,000	314,600	346,500	---	---	87,800	113,600	34,450	27,720	95,100	119,700	---	---	2,700	1,410	---	---	654,250	758,930
Sugar Beets Acreage	---	---	320	310	---	---	---	---	---	---	---	---	---	---	---	---	---	---	320	310
Tons	---	---	1,430	2,620	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1,430	2,620
Alfalfa Seed Acreage	---	---	100	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	100	---
Bushels	---	---	190	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	190	---
Miscellaneous Acreage	500	430	1,340	2,320	---	---	1,240	1,500	170	---	730	380	---	---	---	---	---	---	3,980	4,630
Bushels	1,000	95	190	215	---	---	1,270	1,480	2,920	---	380	240	---	---	---	---	---	---	5,760	2,030
Crop Planted but Not Harvested Acreage	600	940	3,890	1,550	---	---	9,800	11,010	1,170	1,350	1,900	3,610	---	---	200	100	---	---	17,560	18,520
Crop Lands	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Irrigation Acreage 1/	231,020	---	41,350	---	2,000	---	82,850	---	16,930	---	88,150	---	---	---	8,400	---	768	---	471,468	---
Non-irrigation Acreage	5,400	---	24,740	---	400	---	111,890	---	19,620	---	29,460	---	---	---	3,000	---	1,792	---	196,302	---
Total	236,420	---	66,090	---	2,400	---	194,740	---	36,550	---	117,610	---	---	---	11,400	---	2,560	---	667,770	---

1/ Montana Agricultural Statistics, Dept. of Agriculture, Labor and Industry - 1950

2/ Estimated amounts from bulletin 1/ due to only partial counties represented.

3/ Lewis & Clark area all grazing lands and rough.

4/ Includes irrigated hayland and pastures.

The Big Hole Basin, in the extreme southwestern part of the area, has one of the largest areas of irrigated wild-hay meadows in the West, totaling approximately 150,000 acres. It is at an average elevation of 6,200 feet. This high elevation and short growing season precludes the growing of any other crop.

In the southern end of the basin, particularly in the Red Rock and Horse Prairie Creeks and upper tributaries of the Jefferson River, irrigation farming consists chiefly of raising wild hay which is used for a feed base by the cattle and sheep industries. Beaverhead River Valley is a noted hay producing section. Further down the Jefferson River, below Silverstar, other crops are grown along with alfalfa and wild hay.

Beaverhead County is the leading county in Montana in livestock production. Gallatin County was seventh in 1949, and Madison County was eighth. There is relatively little arable land in Beaverhead County, so cultivated crop production is comparatively small. Beaverhead County was eighth among Montana counties in the value of all farm products sold in 1949. Gallatin County was in seventh place in all classifications of agricultural products sold in 1949; that is, the total of crops, livestock and livestock products. Madison County has so little arable land that it placed seventh in the value of all farm products sold. The 1949 values of farm products sold in the five counties are as follows:

Value of Farm Products Sold, 1949 1/

County	Crops	Livestock and Livestock Products	Total Receipts from Marketings
Beaverhead	\$ 1,393,000	\$ 9,698,000	\$ 11,091,000
Broadwater	2,265,000	2,264,000	4,529,000
Gallatin	6,457,000	5,119,000	11,576,000
Jefferson	820,000	1,538,000	2,358,000
Madison	1,544,000	4,737,000	6,281,000
Total	\$12,479,000	\$23,356,000	\$ 35,835,000

1/ Based on Montana Agricultural Statistics, 1949, Volume III

There are five counties completely or largely within the area. The relative rank of these five counties among all Montana counties in the production of various crops and the numbers of livestock on farms is given in table 9.

Table 9 - Rank in Crop Production and Livestock Numbers of Upper Missouri River Basin Counties Among the Montana Counties, 1949 1/

Livestock Numbers
on Farms January 1

Quantity Produced During Year

Crop

COUNTY	Dry Peas	Mustard Seed	All Hay	Alfalfa Hay	Wild Hay	Alfalfa Seed	Sweet Clover Seed	Crested Wheat Seed	Apples	Acres Harvested, All Crops	Irrigation Acres, All Crops	Winter Wheat	Spring Wheat	Corn	Oats	Barley	Rye	Potatoes	Sugar Beets	Flax Seed	Horses and Mules	All Cattle	Milk Cow	Sheep
Beaverhead	6	-	1	7	1	-	-	30	-	14	1	44	34	-	18	28	19	5	-	12	1	1	30	2
Broadwater	-	2	28	21	36	-	-	35	-	40	20	13	33	-	12	16	-	1	19	-	38	31	37	35
Deer Lodge	-	-	30	37	8	-	-	-	-	53	25	47	49	-	35	31	-	6	-	-	54	55	39	42
Gallatin	5	-	2	1	14	-	5	8	-	18	3	5	14	-	1	2	4	10	-	-	4	9	4	25
Jefferson	-	-	39	41	33	-	-	-	-	49	31	22	39	-	48	37	6	17	-	-	37	43	28	43
Lewis & Clark	-	-	12	17	7	-	-	9	-	35	18	16	37	30	32	40	24	8	-	-	25	22	19	19
Madison	-	-	3	3	12	-	-	15	-	31	2	18	31	-	10	17	-	9	-	-	9	15	20	3
Meagher	-	-	11	33	25	-	-	-	-	43	16	48	55	-	29	51	46	50	-	-	29	27	54	5
Silver Bow	-	-	52	53	37	-	-	-	-	55	41	50	56	-	55	55	16	25	-	-	50	53	42	48

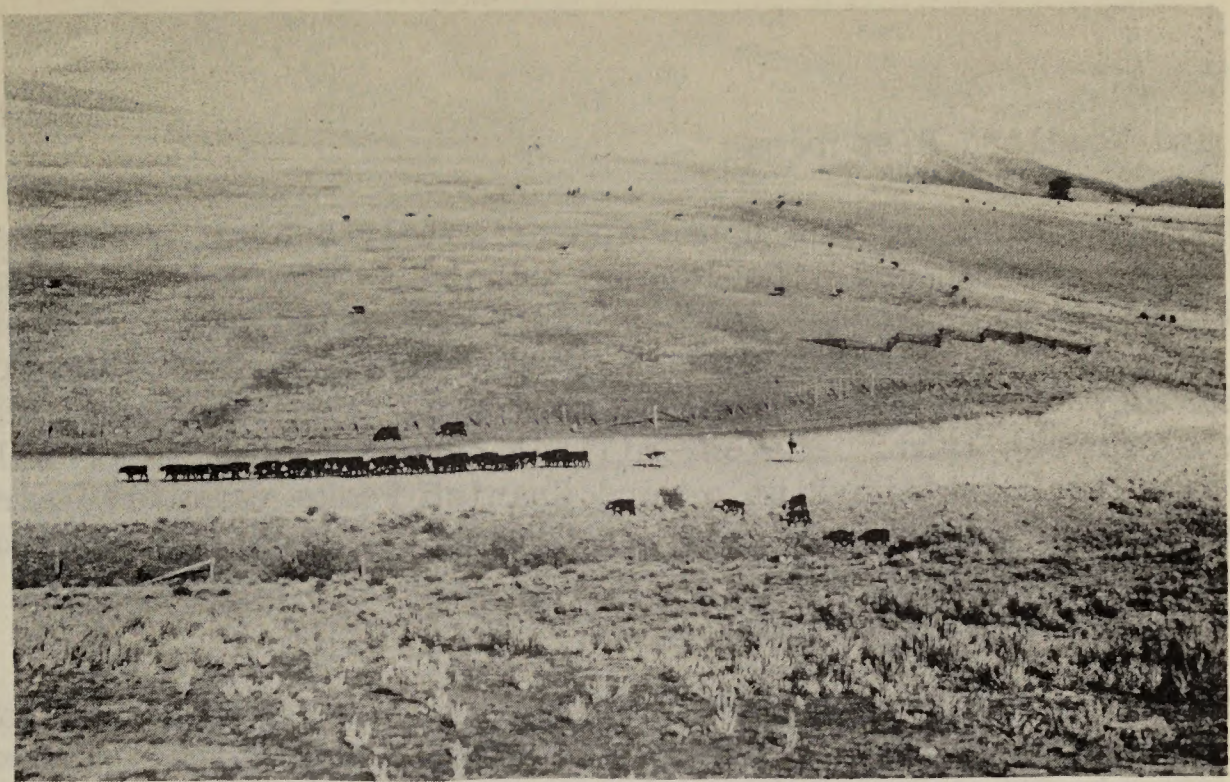
1/ Montana Agriculture Statistics, Montana Department of Agriculture, Labor, and Industry - 1950

(*) Illustration: In 1949, Beaverhead County held fourteenth place among fifty-six counties in number of acres harvested of all crops; first place in number of irrigated acres harvested; and forty-fourth place in number of bushels of winter wheat harvested; first in all hay produced; and first in cattle and horses.

The basin supports about 357,480 animal units calculated on the basis that five sheep are equivalent to one horse or one cow. According to the Montana Agricultural Statistics of 1949, there are 264,600 cattle, 335,400 sheep, and 25,800 horses. A number of sheep and cattle are fattened in feed lots on local hay and grain in the Gallatin Valley. The headquarters of the stock ranches in this basin are located principally in the valleys. In these valleys, hay is usually fed continuously from three to five months during the winter. Hay is the principal food supply during the winter, and the meadows are used as a source of pasture along with grazing land during the fall, winter, and spring grazing. To avoid the high costs of putting up hay and winter feeding, many operators are using meadows as irrigated pastures for steers during the summer and fall.

The ranches in this area vary greatly in size. The minimum number of stock required for reasonably good living for a family will also vary according to individual circumstances. As a rule, 200 head of cattle, or 1,000 head of sheep is considered the minimum number for efficient operation. Assuming that summer grazing is provided by Federal permit, a ranch with 200 cattle in this area should own or control three to five sections of land for spring and fall grazing. In addition, 150 to 200 acres of meadow would be required for feed production. Such meadows are also customarily used for spring and fall grazing.

The National Forests and the public domain lands include the more rough and mountainous range and timbered parts of the basin. Permits or leases are required for the use of these lands. They are usually granted to operators of established ranch units which provide grazing part of the year and which produce a sufficient supply of winter feed for the stock covered by permits or leases. Grazing under permit or lease is usually obtained at a lower cost than on privately-owned land. Public domain and national forest lands play an important part in the ranch industry of the area.



Cattle being gathered for winter feeding along the Dillon-Jackson road in the Big Hole area.



Horses are still the principal power on many of the ranches in the Upper Missouri Basin. Haying in the summer and feeding in the winter make dobbing economic despite his passing out of the picture elsewhere.

Timber and Woodland Resources

The Upper Missouri Basin has approximately 3.5 million acres of forest land. Beaverhead, the largest county in the unit, has more than one million acres of forest land. This county also has the greatest forest area of the counties east of the Continental Divide in Montana. Approximately 73 per cent of the total forest area is classified as commercial forest land. The one million acres of non-commercial forest area includes the Pintler and Spanish Peaks primitive areas and all of Yellowstone Park which is within the area. These non-commercial forest areas have some of the most beautiful scenery in the West.

Forests of the area are almost entirely coniferous. The pattern in the foothills is usually one of Rocky Mountain juniper or common Douglas fir in pure or mixed stands. At higher elevations, lodgepole pine is found in extensive pure stands. On the lower fringe of the lodgepole pine type, it is common to find a narrow belt of common Douglas fir. Engelmann spruce of commercial value generally occurs along the creek bottoms or in low, wet areas in the higher elevations. Near the Continental Divide (which forms the west and south boundary of the basin) and on top of other mountain ranges, the sub-alpine non-commercial forest is found and contains such species as limber pine, whitebark pine, Engelmann spruce, and alpine fir. Along the streams and on the outer edges of the Douglas fir types, stringers of cottonwood or Eastern poplar are found.

The area has a stand of approximately 7.5 billion board feet of timber on commercial forest land. Conifers make up 99 per cent of this volume. Of this, Douglas fir comprises 45 per cent, lodgepole pine 30 per cent, Engelmann spruce 16 per cent, and other species 9 per cent. Nearly two-thirds of the board feet volume is in saw timber. The remainder is in pole stands, open woodlands, and as residual volume in very young reproduction stands. Much of the timber cut in the basin in the past has been for railroad ties, fences, and local needs. Local residents obtain considerable quantities of fuel wood, (both green and dead) fence posts, house logs, and other materials. The extensive lodgepole pine forests of the basin are a ready timber supply for the expanding demand for transmission and telephone poles. One of the advantages of these stands, from the standpoint of pole production, is their location on the edge of the plains country which is close to a major market. Straight, slender form and ease of preservation treatment have made the lodgepole pine attractive to the producers. Pulpwood cutting in lodgepole pine stands started shortly after World War II. High yields of woodpulp per cord of pulpwood have given the basin's lodgepole pine a favorable place in distant markets. Areas of lodgepole pine offer possibilities for expanding pulpwood production.



Airplane view showing timber and grassland along road east of Monida, Montana.

Photograph by W. E. Banko



Winter scene in the timber near Wise River, Montana, on the Big Hole River Drainage.



Lodgepole pine stand along U. S. Highway No. 191
between West Yellowstone and Targee Pass

Douglas fir is the principal sawlog species. Such items as bridge planks, mine timbers, stringers, and rough construction lumber make up the bulk of fir production. Next to Douglas fir in importance as a sawlog species is lodgepole pine. Lumber from this species is of good quality and similar in many respects to ponderosa pine.

Of the approximately 3.5 million acres of forest land in the basin, about 237,000 acres or 6.7 per cent of the total are public domain land. The forest acreage of public domain is located in the Upper Centennial Valley, Ruby Mountains, and the area from Divide, Montana, to Ralston, Montana. There are also scattered areas that are too numerous to mention in this preliminary report. Nearly all of the forested area of the basin is within national forests or Yellowstone National Park. A small percentage of the forest lands is privately owned.

Mineral Resources

Mineral resources of the Upper Missouri Basin are largely undeveloped due to inaccessibility and partly to the low grade character of many of the deposits. They are widely scattered through all parts of the basin and, because of the nature of the mining law, present various problems in land administration.

During the process of deposition of erosional materials in the great seas which occurred from time to time, beds of coal, phosphate, limestone, oil shale, gypsum, and other minerals were formed. Folding and erosion has limited their extent, but outcrops are widely distributed.

Large deposits of low to medium grade phosphate rock exist in the area. Phosphate rock is mined at the Maiden Rock Mine on the Big Hole River near Divide. Prospects are located on Canyon Creek, La March Gulch, and Dry Gulch. Mining and prospecting are active in order to supply the new Victor Chemical elemental phosphorus plant at Silver Bow located west of the area. Known deposits are located on the upper reaches of the Beaverhead, Ruby, Madison, and Gallatin Rivers.

Steatite talc is being actively mined in the area. Coal is being sporadically mined in Beaverhead County in small quantities. Great cliffs of Madison limestone of good quality are exposed and available when needed for industry. Dolomite, sand, and cement materials are available. Marble has been quarried in Broadwater County for building purposes.

Placer gold was found in the sixties in various localities of the basin and caused an influx of prospectors who quickly found and developed lode deposits. Placer mining is still active in isolated areas, but it is unimportant. Lode mining, however, is widespread in Beaverhead, Broadwater, Jefferson and Madison Counties and gold, silver, lead, zinc, and copper ores are being produced. Due to economic conditions, many mines of value are inactive at the present time. Other prospects, due to inaccessibility, lawsuits, or other conditions, are undeveloped and non-productive but have good potential values. Recent increased demand and advancing prices for critical metals will promote mining activity in the area. Other minerals discovered at various points are manganese, molybdenum, platinum, vanadium, tungsten, diamond, corundum, graphite, and uranium. An extensive deposit of low grade tungsten producing ore is located northwest of Dillon. Recent exploration points to the possible construction of a large concentration plant in the area. Graphite is being mined sporadically in Beaverhead County; uranium, recently discovered in Jefferson County, is now being developed. There are possibilities of uranium deposits in other sections of the basin, and prospecting is very active.

Production

A report of the State Board of Equalization shows the production of metal mines in 1947 to be approximately as follows:

Beaverhead County	\$ 98,140.00
Broadwater County	112,733.00
Jefferson County	150,000.00 (estimated)
Madison County	213,258.00
Silver Bow County	1,000.00 (estimated)
or an estimated total of	\$575,131.00

Recreation

Recreational activities are an important feature throughout the Upper Missouri Basin. Yellowstone National Park, 18 per cent of which lies within the basin, attracts tourists from all parts of the world. The Park attracts over a million visitors annually during the summer months. Lewis and Clark State Park is enjoyed by thousands of tourists each season.

The surrounding national forests and primitive areas abound in scenic drives, picturesque horse trails, clear trout streams, cabins and cabin sites, historic placer "diggings," and big-game areas. The wilderness or primitive areas of the national forests were set aside to preserve natural primitive conditions. Roads and buildings are prohibited, and only the most necessary trails will be built in these areas. Hunting and fishing are important uses of the national forest lands.

Ranches which formerly depended entirely on livestock for their income, now supplement this with returns from a dude-ranching business. On some of these ranches the recreational venture now predominates, and the livestock operation is little more than a feature to attract and entertain the guests. The development of a recreational use of the range has become an important factor in the social and economic life of the basin. Tourist trade totals approximately \$25,000,000 annually in the basin during normal years. (Senate Document No. 191 - Missouri River Basin, 1944)

The innumerable small lakes and mountain streams offer a wide variety of recreational opportunities. Accomodations in these areas range from simple roadside cabin camps, with minimum conveniences, to

well-appointed hotel resorts and dude ranches equipped for a variety of activities. Picnic grounds in these areas have been made available through private enterprise and by Federal and state agencies. On these lakes and streams, or in other particularly attractive locations, long-term leases are granted for construction of summer homes by Federal and state government agencies.

Fish and Wildlife

The Upper Missouri River watershed is an area of importance in the management of wildlife. This watershed is highly productive of all forms of native wildlife, and the upper reaches of the watershed are considered by the Fish and Wildlife Service to be an important waterfowl breeding grounds. With proper management, wildlife can become more abundant on the Upper Missouri River watershed. Game can be produced in substantial numbers in conjunction with agriculture if given adequate consideration in the planned manipulation of the land and water. Wildlife is completely protected within Yellowstone National Park. Many of these animals migrate into the other parts of the basin from the park.

Excellent habitat for a wide variety of native animal and bird life are provided by the forested mountains, cultivated valleys, and numerous lakes and streams of the Upper Missouri Basin. Trout are found in all of the streams and lakes, and some of the lakes contain fish of other kinds. Fishing and hunting are recognized as an important asset of the basin which undoubtedly will grow in economic value with increased tourist travel.

The Red Rock Wildlife Refuge was established in 1935 to protect the last of the trumpeter swans. It comprises more than 40,000 acres of land in Beaverhead County which is located near the head of Red Rock River. Each year hundreds of visitors see this refuge which has been maintained for the protection of this beautiful bird. This refuge has preserved this bird. The 1950 count of the trumpeter swan was 368, as compared with only 75 when the refuge was established in 1935.

The basin supports a number of species of big game and other animals. Deer, elk, bear, moose, buffalo, and mountain sheep inhabit the higher mountain areas. Deer and some elk are found in foothill areas at low elevations during the winter and, to some extent, throughout the year where most of the public domain lands are situated. Antelope, a plains animal, inhabit the range lands at lower elevations. The estimates for big-game animals in the basin include 38,400 mule deer, 1,650 whitetail deer, 16,800 elk, 2,950 antelope, 845 mountain goats, 344 bighorn sheep, 1,489 moose, and 2,383 bear. These estimates of wildlife population are based on reports made by representatives of

various Federal and state game management agencies. In addition to the big-game animals, there are numerous fur-bearing animals such as beaver, muskrat, badger, and fox. Predatory animals have decreased within the area during the past few years due to improved methods of hunting, poisoning, and trapping. The present ones are bobcat, lynx, coyote, mountain lion, and bear. Numerous game birds, including sagegrouse, pheasant, ducks, ruffed grouse, pintailed grouse, mourning doves, and geese are found in the basin.



Private herd of Buffalo grazing with domestic livestock east of Armstead, Montana.

PROBLEMS RELATING TO THE PUBLIC DOMAIN

A reconnaissance survey and an analysis of published reports and public records has revealed many problems relating to the management, protection, development, and utilization of the public domain lands and their resources. These studies have not been in sufficient detail to determine either the scope and seriousness of these problems or measures for dealing with them. This preliminary survey and report is to determine and describe in general the role of the public lands in the development program and to point out the principal problems confronting the Bureau of Land Management in providing for the maximum contribution and service of these public lands to the comprehensive resource development program. Further investigations will be necessary. The detailed survey will probably discover other problems besides those listed. The following major problems relating to the public domain are found to be the most important at this time.

Complexity of Land Ownership Pattern

The land ownership pattern is very complex. National forests have been established on most of the higher forest and summer range areas. Private acquisition through homesteading has taken up most of the valley bottoms. Grants to the state and to the Northern Pacific Railroad make up an important portion of the area. Also, the state has made many lieu-land selections in the public domain area. Patented mining claims are scattered throughout the basin. The Northern Pacific Railway Company was granted much of the area, but a great portion of their lands have been sold.

The public domain map in the appendix shows the location and extent of public domain lands and other Federal land management programs in operation in the Upper Missouri River Basin. Federal land disposition, exchange, and acquisition programs have been operating for many years. Piecemeal attacks on the land ownership problem have been made in the past. A comprehensive approach to the entire problem is necessary.

Superficial analysis of the area as to land capabilities and land use indicates that many of the isolated and scattered tracts of public domain land could be better utilized and managed under private ownership. Further detailed studies for each of these tracts of land, as well as a comprehensive study of the entire land-use economy of the area, is necessary to develop a sound policy and approach to a more effective land administration and resource utilization of the basin.

The topography, with a predominance of irregular terrain, has been a prime factor in influencing the settlement of this region.

It is responsible to a large extent for the resultant complex land pattern. Practically all of the isolated tracts are either too rough, too remote, too dry, too isolated by mining claims, or otherwise too worthless (from a ranching or mineral standpoint) to justify private ownership. As shown on the map, most of these areas involve considerable acreage. The possibility of improving the land-ownership pattern through disposition of these smaller isolated tracts and consolidation of the Federal range ownership is more favorable at the present time than it has been for several years. Applications for purchase of these isolated tracts are being made in considerable numbers. Grazing lessees have indicated an interest in buying the isolated tracts scattered within their holdings.

It is possible that public domain lands that are isolated could be offered as trading stock to private individuals or to the state of Montana in return for certain privately-owned or state lands located in areas that are predominantly public lands. In this way, the land pattern could be improved by consolidating public land to the advantage of the Federal Government, individuals, and states.

A land adjustment program is needed in areas adjoining national forests where the public lands are primarily suitable only for watershed and timber production. Such lands should be administered in conjunction with the Forest Service lands.

There is a need for more factual information and accurate current records relating to the land management programs and projects of all Federal and state agencies in the area. The effect of public domain land tenure on the operation of these programs should be carefully considered. The many and varied uses of lands and their relationship to the public interests and public problems must be fully considered in the comprehensive study of the basin.

A problem indirectly related to the problem of land tenure and public land control is the need for cadastral surveys, so that property boundaries may be correctly located. In addition, there is need for proper identification of unpatented mining claims. The detailed field investigation will reveal the areas in need of re-establishment and re-monumentation of public survey corners.

Maladjustments in Public Land Use

Many areas in the basin contain a variety of resources including timber, range forage, mineral, water, wildlife, and recreation. Rarely is there an instance in which two or more of these resources are not associated on any given piece of land. Some one of these resources may be dominant, but others are always present in amounts to require consider-

ation in land management. This association of these resources injects the necessity for multiple resource management.

It is important that all resources of public lands be given adequate consideration when administering these lands. This brings up the problems confronting most of the administering agencies which deal with multiple uses. Some of the most important factors or problems to be considered in the management of the multiple resources of this basin are:

(a) Some of the timbered areas are not accessible by road. Proper protection, utilization, and administration cannot be accomplished because of lack of access. Information available indicates that road development is necessary for the protection of the timber and the watershed resources of the land. The detailed investigation will determine the feasibility of access roads in the timbered areas and provide an inventory necessary for the establishment of a management plan for the proper disposition of the timber resources. Public lands suitable for timber and watershed, which are located adjacent to national forests, may be managed in conjunction with the national forest land. The detailed investigation will delineate these areas and determine the feasibility of such adjustments.

(b) The basin is made up of tributary watersheds, the nature of each being of importance to the welfare of the people living in it and below it. One of the most important responsibilities associated with the administration of range and forest lands is protection and management for watershed purposes. Watershed management is defined as the administration and regulation of the aggregate resources of a drainage basin for the production of water and for the control of erosion, stream flow, and floods.

There are four phases of watershed management. One is the recognition phase which involves a survey to determine the extent, location, and severity of deterioration on misused areas. Second is the restoration phase which includes the improvement of the misused areas by revegetation or other conservation methods. The third is the protection phase which involves not only the protection from fires or other damaging agencies, but the maintenance of existing conditions, providing that they are acceptable to the use to which the area is subject. The fourth is the improvement phase which involves practices that are initiated to increase the yield of water. The detailed investigation will delineate the areas of deterioration and plan for the improvements and the protection necessary to administer these areas in order to improve and stabilize the yield of water.

(c) Recreation is important to the individual and to society. It is also of importance economically, and especially so in this area. Fundamental to recreation opportunities are the natural resources of an area which may include streams, rivers, lakes, forests, and mountains. In the Upper Missouri Basin, all of these fundamental resources are present in abundance, but they are not distributed so as to afford equal opportunities to each locality. Like all other natural resources, recreational resources occur where nature has scattered them and without any orderly relationship to human demand. Physical factors play an important role in determining suitability of land for recreational uses as well as it does for agricultural and forest lands. The relative importance of various factors is considerably different; they operate within more definite limitations of geographical factors than in the case of agricultural and forest lands.

The determination and the expanding of recreational possibilities have never been intensively studied on public domain for the purpose of placing such recreational areas under development. Increasing demands for recreational areas will undoubtedly develop as the Upper Missouri development program expands. This condition demands that a detailed study be made of all public domain so that no areas which have recreational possibilities will be overlooked.

The use of the lands for recreation seldom need interfere seriously with other uses. In some local areas of especially high recreational value where the concentration of people is high, (such as areas close to Helena, Bozeman, and other towns) it may be desirable to exclude livestock grazing at least during some periods of the year. Normally, water supply intakes for use on camp grounds and heavily used camping areas should be fenced against livestock. In such instances, the limited value of the forage resource left unused, as compared to high recreational values involved, will leave little basis for objection to such closure. The comprehensive study of the basin will reveal all the possible land uses which are best in the public interest, and will thus serve as a guide to the administrator in the management of the public lands in accordance with optimum and multiple use principles. This study will also indicate areas suitable for recreational use, their importance, and the proposed improvements needed to bring areas to their highest use.

(d) Wildlife use and habitats in the basin have been, and will continue to be, altered by increasingly intensive use of the region by man. Water resources should be developed with every feasible provision to minimize fish and wildlife losses and to increase benefits from both of these sources as much as reasonably possible.

A major problem in big-game management in the Upper Missouri Basin is the shortage of winter range for elk and deer. Elk have caused serious damage to ranchers' property, especially hay and fences. The Madison and the Big Hole winter ranges are two problem areas in the basin. In order to formulate a workable management plan, a careful study of range conditions should be made by representatives of the Fish and Wildlife Service, Bureau of Land Management, U. S. Forest Service, sportsmen's associations, fish and game departments, other agencies, and by the ranchers upon whose lands these herds winter. The proposed plan, determined by all groups concerned, may bring about limitation of elk numbers which will produce a game crop to be harvested annually and, at the same time, provide adequate feed and ground cover to protect other interests.

Studies made by fish and game departments and observations of the vegetation on the winter range indicate an overuse and deficiency of winter forage in the Ruby area. The Ruby area deer herd has increased beyond the optimum number which can secure feed from the area usable as winter range, and the herd is still increasing. The 1949 census shows an increase of deer over that of the previous year. The deer herd in the Big Hole (Jerry Creek and Wise River) has also increased beyond supply of winter feed, killing out browse. Since the coyote population has been materially reduced throughout this area, it is reasonable to assume that the fawn crop will be higher in the future than in the past, and that death loss by other predators will also be reduced. These facts lead one to anticipate a more rapid rate of increase in deer in this area, unless the breeding stock is considerably reduced.

Wildlife is a product of the land, hence it is obvious that the pattern of land use developed in pursuit of agriculture will, in a large measure, determine the abundance or scarcity of wildlife. Wildlife use vegetation as shelter, and if the shrub and tree cover is destroyed by man, wildlife will disappear. Wildlife management strives to maintain animal population at a desirable level through provision of a good habitat. To a large extent, it is simply good land management. Insofar as it is land management, it is closely allied with soil conservation.

The Red Rock Lakes-Cliff Lakes area in southern Madison and Beaverhead Counties at one time had great bands of bighorn sheep and was noted as a hunting area for these animals. Bighorns were found over a great part of Madison County, as well as the area along the Continental Divide up to and including the south part of Deer Lodge County. The last of these animals disappeared in these two areas about twenty years ago. A study of the area should be made relative to the planting of bighorn sheep. Also, further examination should be made to

provide lands for game refuges, as well as winter feeding grounds, for elk and deer.

(e) The forage on public ranges is used by livestock from the farms and ranches. Livestock in the basin is being fed increasingly on farm forage crops. The crops are largely dependent upon irrigation water from forest and range watersheds. The use of the public range and forest land, and private range and farm land, is interrelated in many other ways. This problem of forage involves all the problems which have been previously mentioned. It must be considered in connection with all of the other problems.

The use economy of most of the land in the Upper Missouri Basin is built around the range livestock industry. The use of irrigated areas should be integrated with surrounding non-irrigated and range lands so that together they will form well-balanced ranching units. The production of additional feed by irrigation will no doubt bring about a substantial increase in public range demand in an attempt to balance the operations with lower-priced range feed. It is probable that the demand for public range will be greater with the completion of the irrigation program now in development.

Since most of the land in the basin is used for grazing, range management plays an important role in the management of these multiple resources. A management program should be planned to properly protect, develop, and utilize these resources. Some of the most important range management problems are: proper seasonal use, proper rate of stocking, and proper distribution of grazing use. Consideration of these factors determine what additional range-use facilitating projects are needed. Another problem that is becoming an ever-increasing one is trespass. The detailed land classification should consider all these problems so that information may be gathered to properly form a management program that will eventually eliminate these problems.

(f) The Federal and State laws relating to the location and patenting of mining claims were formed in 1872 and were an outgrowth of the regulations and customs initiated in the early-day mining district organizations. They permit the location of mining claims in the direction of and along the outcrop of lodes which run at all angles to the cardinal points. Regulations relating to marking the boundaries of mining claim locations and of fixing their location relative to permanent monuments are very general and, as a consequence, there are great numbers of valid locations which cannot be identified except by the locator who established their position.

Mine locations are filed in the office of the local county recorder, and are often described so poorly that their locations cannot be determined from a study of those records. In most of the mineral district, the records indicate a vast number of these mining claims which, in many cases, overlap or cover the same ground, thus causing much confusion and uncertainty as to the status of an area. The moratoria on assessment work, which has been continuous for a number of years, has further complicated the problem of determining the location and validity of many claims inasmuch as many claimants have failed to do any assessment work or even to visit the locality of the claims. Patenting of these claims fixes their location through accurate surveys by government employees or appointed mineral surveyors. Because claims are located at various angles to the cardinal points, there are a great many small triangular areas left unpatented. The administrator has great difficulty in locating and administering such areas. The gross area in mineral claims, patented and unpatented, makes up a large acreage in the basin.

The presence of mineral in much of the area creates a further problem for the administrator on grazing or agricultural lands. Mining operations quite often interfere radically with the use of the surface along vital streams and watering places, also along roads and at times in areas valuable for forage or timber. The surface of unpatented lode claims is subject to possessory right of the mining claimant, who has exclusive use of the timber and other resources when they can be used for mining purposes. The administrator of the surface of public lands is unable to determine without a great deal of research and difficulty whether lands containing timber or grazing resources are subject to his administration, or whether they are the property of some absentee mining claimant.

Another gradually increasing problem is the location of mining claims as an excuse to acquire sites for recreation, valuable timber resources, or for other non-mineral purposes. Under the mining laws, a lode claim may be located to cover 20 acres, and the problem of the discovery of mineral can often be met. Assessment work, consisting of \$100 spent for mining development per year, has been waived by law for many years. Failure to do the assessment work cannot be used by the Federal Government as a basis for cancellation of the mining claim. Action in the department of the courts is often necessary to show the fraudulent intent of the locator in such cases.

Because of the steadily increasing importance of metals and other mineral products to a nation which is growing more and more deficient in metal resources, it is essential that the mineral remaining in the ground be judiciously exploited.

Mineral resources should be developed so as to conflict as little as possible with other land uses. Mineral development should not be interfered with or discouraged. If conflicts occur, the matter should be adjusted for the benefit of the best public interest.



An example of multiple land uses near Bannack, Montana, on Grasshopper Creek where mining, grazing, timber, wildlife and watershed uses are intermingled. Trails, roads and other developments of mines and prospects cause erosion and interfere with grazing and wildlife use on much of the area.

Other Related Problems

(a) The livestock losses in the Upper Missouri Basin are not high for a range area. Losses are mainly due to predatory animals, diseases, and poisonous plants. The loss from poisonous plants is a major problem in isolated areas, according to reports, studies, and information received from the Area Manager, Montana V. The comprehensive study to be made will include existence, abundance, and location of poisonous plants.

(b) All fire control activities require a high degree of coordination of manpower, equipment, and materials. To accomplish desired results, the fire supervisor must be constantly and accurately informed concerning all fires. He must be able to communicate instructions and receive information necessary to send supplies and manpower to the fire with the least possible lapse of time. A close second in general value to well-maintained telephone lines is short wave radio equipment. One of the major fields taken by radio communication is in fire fighting activities. Detailed studies should be made concerning the problem of communication to see that a system is installed to meet the needs of the area.

The Forest Service has a contract with the Bureau of Land Management whereby they protect certain designated areas adjoining the national forests. This protection covers different distances from the forest boundary depending on fire hazard. For instance, in the Lima Ranger District, the distance from the boundary is one mile; while in the Madison District, the distance is from one mile to three miles. This difference in acres protected is due to the inflammable material on the ground, as well as other fire hazards, such as lightning. This protection takes care of all fires that are reported or found in or near these areas of responsibility. All other areas in the basin are taken care of by the Bureau of Land Management with the help of the Soil Conservation Service, Rural Fire Fighters Organization, ranchers, and farmers. The detailed land classification studies to be made will delineate fire hazard areas on the map along with sites for the establishment of additional fire caches. The problem of fire control will increase as the use of public land progresses and more intensive protection becomes necessary.

(c) Many of the lands withdrawn for stock-driveway purposes are not being used for the purpose for which they were withdrawn. Since the passing of the Stock Raising Homestead Act of December 29, 1916, the methods of livestock operations have changed so that these driveways are not needed in all of the areas. Some of the driveways still remain intact, while others are being leased for grazing under the Taylor Grazing Act. Further detailed study will be required to obtain more factual information relating to driveways and withdrawals so that some solution may be reached with regard to the use and manage-

ment of the lands involved. The stock driveway systems that are needed for trailing purposes should be provided with improvements and facilities such as stock water, fences, and boundary markers to promote orderly use. Some areas that are now deteriorated will need soil and moisture conservation measures to rehabilitate the depleted resources.

(d) In the administration of public domain lands, the primary purpose is to convey the greatest good to all who are wholly or partially dependent upon the land for their social and economic welfare. By regulating the use of public domain lands and their resources, a full benefit can be realized by all concerned. A study of the appended map which shows the existing district and the Federal range lands within, and the public domain and stock driveway lands in the intermediate area, reveals that the public lands outside grazing districts might be better administered and controlled if placed within the grazing district.

PROPOSALS FOR DETAILED CLASSIFICATION AND PLANNING

OF THE PUBLIC DOMAIN LANDS

Area land classification is undertaken to determine the purpose for which the public domain lands are suited; the extent, location, and condition of their resources, and the needed use adjustments, improvements, and developments for these lands. The physical characteristics of the public domain lands are known in a general way, but detailed basic land information is available for only a very small portion of the land in this area. The first step necessary in the preparation of plans for the most effective use of these lands is their examination, classification, and an inventory of the resources located thereon.

Other public lands under the jurisdiction of the Bureau of Land Management previously classified and set aside as stock driveways, water reserves, and mineral lands, are in need of further detailed study to determine the best specific use for each site. Many withdrawals are conceded to be no longer necessary and, in some cases, create difficult problems of management and administration.

Problem Areas

Detailed studies necessary to the solution of the problems mentioned on the preceding pages will be carried on by the Bureau of Land Management. For the purpose of investigation and classification, the Upper Missouri Basin will be subdivided into the following four areas:

1. The upper watershed, which will include all the drainage basin above Whitehall, Montana, except the Big Hole River above the

town of Divide.

2. The lower watershed, which includes all the drainage basin above Canyon Ferry Dam to Whitehall, Montana, on the west side of the Missouri and Jefferson Rivers.

3. The Big Hole River, which will include all of that drainage basin above the town of Divide.

4. The remainder of the watershed, above Canyon Ferry Dam.

Areas 1 and 2 have been delineated from the others due to the large extent of public domain lands, as well as the problems existing that need further study. These two areas will have a complete area land classification covering all lands regardless of ownership outside of national forests. Areas 3 and 4 include those portions of the basin which contain relatively little public domain and consist principally of small isolated tracts. Further study of these tracts are necessary to determine what disposition should be made of them and how they should be managed.

Land classification will result in the segregation of lands adapted to specific uses, such as grazing, forestry and grazing, forestry, watershed protection, crop production, wildlife, and recreation. In this detailed field investigation, factual data will be gathered to classify the lands and determine multiple use values. These data are necessary for the solution of the problems previously enumerated, and other problems will, no doubt, be found which will also require study.

Charged with the responsibility of properly managing and administering twelve per cent of the total land area in the Upper Missouri Basin, the Bureau of Land Management is directly concerned with the problem of achieving proper land use for all lands within the basin under a fully integrated and coordinated program of resource development and use. Progress toward this objective can be made only after a careful inventory of the lands and their resources has been made.

11

R. I. M.



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF PLANNING

UPPER MISSOURI RIVER BASIN PUBLIC DOMAIN MAP MONTANA

BILLINGS DRAFTING OFFICE

APRIL 1949



LEGEND

BOUNDARIES

- AREA BOUNDARY
- STATE BOUNDARY
- COUNTY BOUNDARY
- SOIL CONSERVATION DISTRICT BOUNDARY
- GRAZING DISTRICT BOUNDARY
- FOREST

LANDS (See Note)

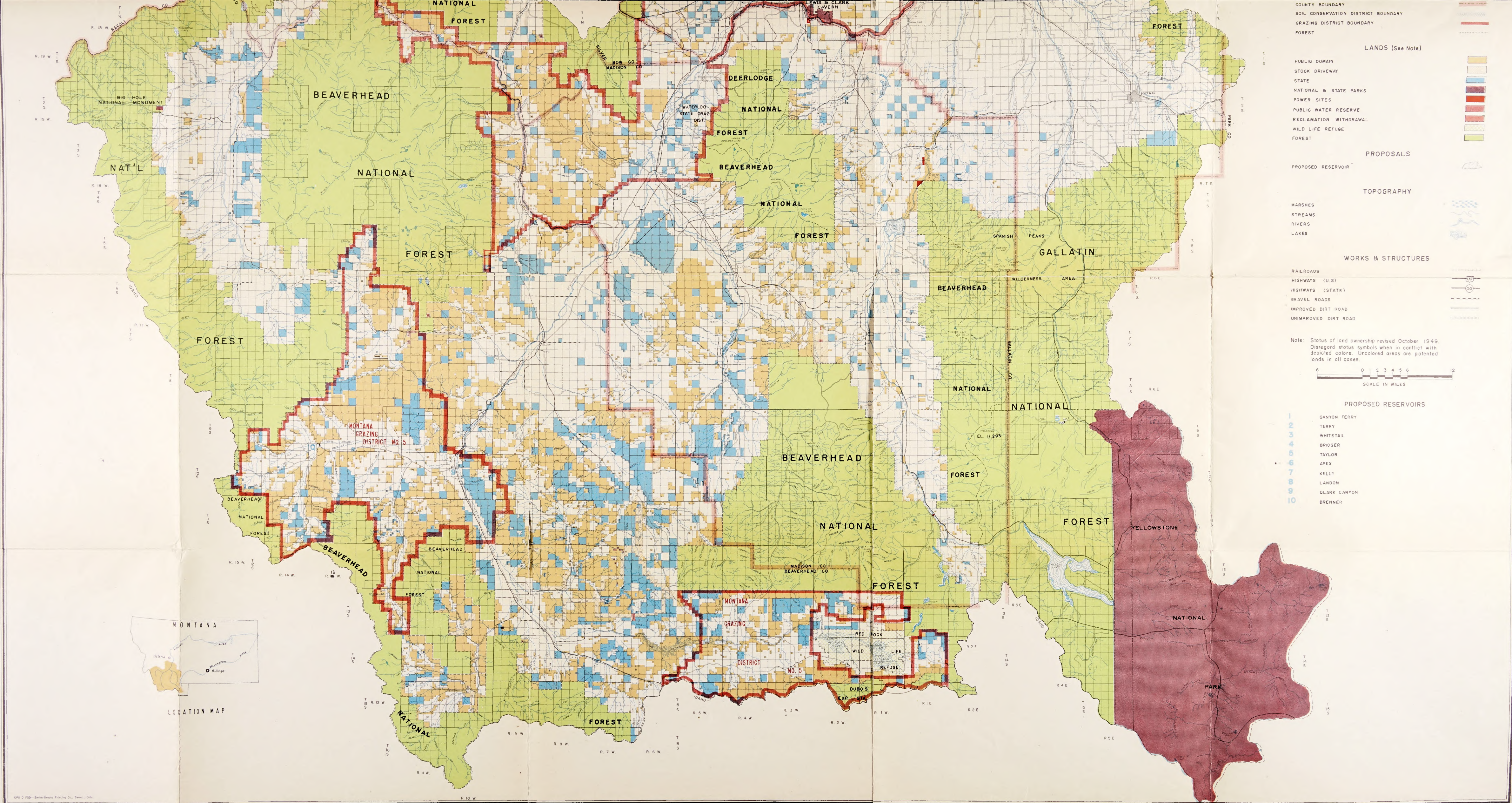
- PUBLIC DOMAIN
- STOCK DRIVEWAY
- STATE
- NATIONAL & STATE PARKS
- POWER SITES
- PUBLIC WATER RESERVE
- RECLAMATION WITHDRAWAL
- WILDLIFE REFUGE
- FOREST

PROPOSALS

- PROPOSED RESERVOIR

TOPOGRAPHY

- MARSHES
- STREAMS
- RIVERS
- LAKES



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